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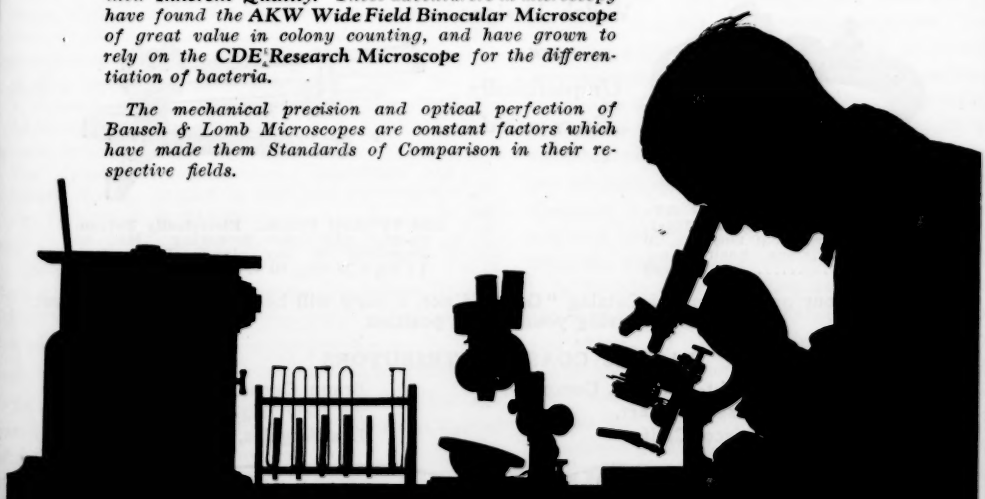

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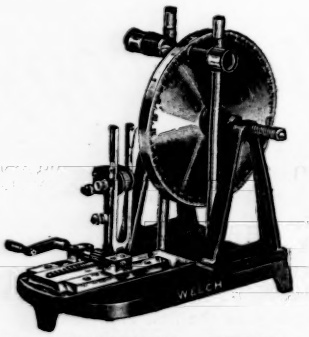

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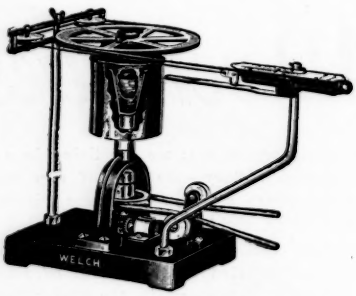

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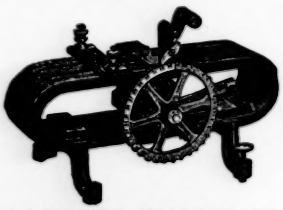

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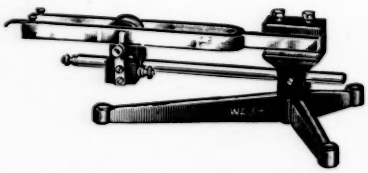

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RECENT DISCOVERIES RELATING TO THE ORIGIN AND ANTIQUITY OF MAN[1]

IN the great drama of the prehistory of man converge all the many branches of science which have been cultivated and encouraged by the American Philosophical Society since its foundation two hundred years ago. In fact, we do not progress very far in this most difficult, as well as most noble, branch of biological research if we pursue pathways which are purely anthropological or purely archeological. It is such specialistic mode of attack which has led more than one generation of man into pitfalls of opinion and of theory from which there is no escape except by direct retreat. In the list of those who have been compelled to reverse engines are the names of many great anthropologists, among them the renowned Hans Virchow, the still more widely known Ernst Haeckel and, probably to your great surprise, no less a name than that of Thomas Henry Huxley. Virchow opposed the recognition of the Neanderthal skull of 1846 with pathologic and theologic preconceptions. Haeckel also eagerly espoused the Ape Ancestry hypothesis by ignoring the profound cleft between ape and man. Huxley failed disastrously in rating the Neanderthal man with recent types of man and threw Darwin completely off the track of this veritable missing link. Huxley, too, failed to visit the Foxhall quarry of Ipswich, site of the greatest discovery in modern times, namely, the fireplace and tool flint quarry of Tertiary man. Even Jupiter nods when the purely specialistic pathway is pursued.

In the triumphs of modern astronomy, four sciences converge, namely, mathematics, mechanics, physics and chemistry; but, in the triumphs of anthropology, beginning with its dawn in the mind of Blumenbach, 1796, and reaching a succession of climaxes in 1927, no less than twelve of the major and minor branches of science converge, as follows:[2] The astronomy of Croll (1875) and Wallace (1880); the glaciology of Geikie (1894–1914), of Penck and Brückner (1909), of Leverett (1910); the glaciology and river terraces

[1] Address before the American Philosophical Society at Philadelphia, on April 28, on the occasion of the celebration of the two hundredth anniversary of the foundation of the society.

[2] Osborn-Reeds: "Old and New Standards of Pleistocene Division in Relation to the Prehistory of Man in Europe," p. 413.

of Depéret (1918–1921); the paleogeography of Suess (1885), of de Lamothe (1899–1918), of Daly (1920–1926); the clay laminae of De Geer (1910–1921); the loess of Schumacher, of Merzbacher, of Obruchev, and of Soergel (1924–1927). A host of other lines of research conspire to portray the great successive phases in the environment of man.

These great stepping stones of the Age of Man, of the Quaternary, of the Glacial Period, lead to our modern and greatly extended conceptions of the antiquity of man. Whereas Charles Lyell, in his classic work, "The Antiquity of Man," postulated 400,000 years for the Quaternary Period, we have practically multiplied the Glacial Age of Agassiz by four in the demonstration that there were not one but *four* titanic glaciations during Quaternary time and have thereby reached a minimum estimate of 1,000,000 years for the Age of Man.

But to complete the human prehistoric panorama as it is now painted, we can not stop with the inorganic sciences. It is necessary to muster the whole galaxy of organic sciences—botany, including paleobotany; zoology, including paleontology; anatomy, including comparative anatomy and embryology; anthropology, including ethnology and archeology. The latest of the biological sciences to make its tribute is psychology, including comparative and physiological psychology, especially, of late (Tilney, 1926–1927), the localization of functions in the brain, and finally, the latest of the psychic cluster, known as behaviorism. It is our recent studies of behaviorism of the anthropoid apes as contrasted with the behaviorism of the progenitors of man which compel us to separate the entire ape stock very widely from the human stock.

While these twelve or more branches which bear upon anthropology have been advanced chiefly through the brilliant researches of specialists, it is our privilege and opportunity on this bicentenary occasion to gather all the reins and endeavor to present a truly philosophical series of generalizations, which may be summed up in advance under four chief captions:

(1) The antiquity of man is now to be reckoned not in thousands, but in hundreds of thousands of years, and we foresee the soon approaching period when it will be reckoned in millions of years.

(2) The Age of Man, or Pleistocene, can no longer be regarded as Act I of the prehistoric human drama, but rather as the final act, because at the very beginning of the Pleistocene we find the human race well-established and widely distributed over the earth. Act I of the Age of Man is during Tertiary time in what may be known as the "Dawn Man" stage and the "pro-human" stage.

(3) While still supported by very able anatomists

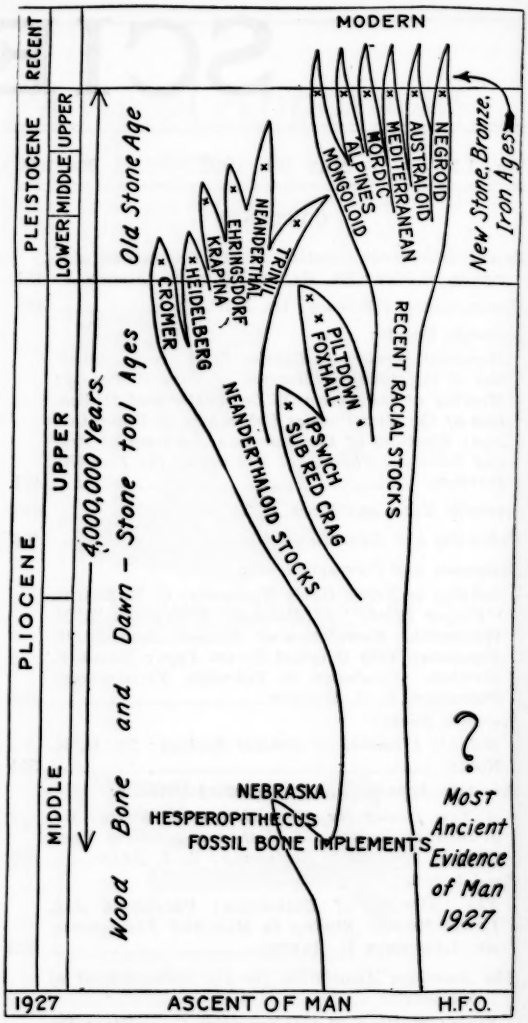

FIGURE 1. PREHISTORIC AND RECENT RACIAL STOCKS

NEANDERTHAL STOCKS (LEFT); PARTLY KNOWN PLIOCENE STOCKS (CENTER); SIX PLEISTOCENE AND RECENT RACIAL STOCKS (RIGHT). (BELOW) LEVEL OF THE SUPPOSED FOSSIL BONE IMPLEMENTS OF THE HERPEROPITHECUS QUARRIES IN NEBRASKA—POSSIBLE EVIDENCE OF MIDDLE PLIOCENE BONE-TOOL AGE IN AMERICA.

such as Gregory, the ape-human ancestry theory is, in my opinion, greatly weakened by recent evidence, and I am inclined to advocate an independent line of Dawn Man ancestors, springing from an Oligocene neutral stock, which also gave rise independently to the anthropoid apes.

(4) The Dawn Man line belongs to a distinct family, the *Hominidæ*, ground-living, cursorial, alert,

capable of tool-making, and living in a relatively open country on the high plateaus and plains of Northern Asia.

(5) The Anthropoid Ape belongs to a distinct family, the *Simiidæ*, tree living, brachiating, sluggish, incapable of tool making, restricted to the forests of south temperate and tropical countries.

LET US ABANDON THE APE-HUMAN THEORY

The prologue and the opening acts of the human drama occurred way back 16,000,000 years ago in the Upper Oligocene Period. At this period, or before, the family of man sprang from a stock neither human nor ape-like, but possessing certain common attributes which have been transmitted over this very long period of time to variously branching races of human beings on the one hand and to variously branching races of anthropoid apes on the other.

In this very ancient man-ape stock (Anthropoidea) resided the affinity which survives to-day in all blood tests, in peculiar susceptibility to or immunity from certain diseases, in resemblance of the hæmoglobin blood crystals, in the uniform division of the teeth to the number of thirty-two, in the extension of the caudal vertebrae into a tail, reversional both in man and apes, and in many psychic characteristics such as curiosity, fear, family protection and courage. It is not surprising that these and other common ape-human characteristics have survived when we see similar survivals among other animal stocks which we know parted company millions of years ago. Of all substances ever discovered, the heredity or the hereditary germ-plasm on which all these survivals depend is the most stable. The germinal stability which has preserved the earliest Cambrian organisms over a period now estimated at 500,000,000 years is also capable of preserving pro-human anatomical and physiological traits for the relatively brief 16,000,000 years which have elapsed since the close of Oligocene time.

Consequently, many of the resemblances between ape and man which have been erroneously cited as proofs of ape-man descent are due either to very remote common inheritance or to the *convergence* of the ape toward the human type. An example of such convergence to the human type is shown in the foot of the gorilla by the recent observations of Akeley, of Morton and of Gregory. I regard the ape-human theory as totally false and misleading. It should be banished from our speculations and from our literature not on sentimental grounds but on purely scientific grounds and we should now resolutely set our faces toward the discovery of our actual pro-human ancestors. In my opinion, the most likely part of the world in which to discover these "Dawn Men," as we may now call them, is the high plateau region of Asia embraced within the great prominences of Chinese Turkestan, of Tibet and of Mongolia. The great plains area north of the high plateau should also be searched, because we have recently determined that this was probably the home of the primitive horse and, according to our theory, the home of primitive man should be looked for in the same kind of country in which the primitive horse flourished.

In abandoning the Haeckel ape theory which reached its apogee in the fantastic speculation of Klaatsch that different races of anthropoid apes gave rise directly to different races of man, we now give an entirely new frame to the human prototype to separate it sharply from the anthropoid ape type. Reconstructing our pro-human ancestors and endeavoring to assign an adequate date to the origin of the pro-human stock, we depend on the science of phylogeny, which has become in itself one of the finest products of human scientific endeavor. Phylogeny made a brave start in the sciences of comparative anatomy and embryology but it awaited paleontology to place it upon a broad and firm foundation. Most of the recent advances in anthropology have been by paleontologic means and methods.

To build up the unknown human prototype by phylogenetic means we must take advantage of the really marvelous knowledge gained from all the minor and greater steps in the ancestry of the horse, of the rhinoceros, of the tapir and of the titanothere since these animals were first discovered in North America by the great Joseph Leidy, of Philadelphia, in 1856. Our pro-human ancestors through their behavior, their tastes, their habits, and their fondness for travel were the architects of their own destiny, as the horses and titanotheres were the unconscious architects of their destinies. Moreover, the open country best adapted to the evolution of the horse is also best adapted to the evolution of the higher races of man. We have determined that the horse did not evolve in Southern Asia or even in the southerly portions of the high plateau regions of Central Asia. To the North is a great unexplored plateau and plains region of Asia which now appears to have been the center of the origin of the family of horses and possibly may have been the center of the origin of the family of man. Certainly, the family of man could not have originated in a densely forested country rich in natural food materials. Man's nomadic wandering instinct, which even in Upper Pliocene time impelled his migrations, is not a forest characteristic but a characteristic of the open country. Almost without exception, precocious human civilizations have been found in open country partly defor-

ested either by secular desiccation or by the severity of the northern steppe climates. Practically the same environmental conditions have favored the precocious development of the finer races of horses.

Secondly, when we at last discover one of our pro-human ancestors in Miocene or even in Oligocene time, the human characteristics will be found plainly stamped on this ancestor, as the horse characteristics are plainly stamped on the Pliohippus, on the Protohippus, on the Mesohippus and even on the Eohippus. It was my observation of the full-bred horse of Middle Pliocene time, known as *Pliohippus leidyanus,* which led me to predict to the National Academy of Sciences the discovery of a full-brained pro-man also in Pliocene time; this prediction preceded the recent demonstration that *Eoanthropus dawsoni* of Piltdown is probably of Pliocene age.

This distinctive pro-human stamp will be seen chiefly in certain outstanding characteristics of habit and of structure which were acquired millions of years ago. In contrast with the Simian and pro-Simian stamp, we may clearly present the chief characteristics in two columns:

HOMINIDÆ (Family of Man)	SIMIIDÆ (Family of Apes)
Pro-human characteristics	*Pro-ape characteristics*
(1) Progressive intelligence, rapid development of the forebrain	(1) Arrested intelligence and brain size
(2) Ground-living bipedal habit — cursorial, adapted to rapid travel and migration over open country	(2) Arboreal to hyper-arboreal quadrumanal habit—living chiefly in trees
(3) Bipedal habit and development of the walking and running type of foot and big toe	(3) Quadrupedal habit when on the ground
(4) Shortening arms and lengthening legs	(4) Lengthening arms and diminishing legs
(5) Development of the tool-making thumb	(5) Loss of the thumb and absence of tool-making power
(6) Walking and running power of the foot enhanced by enlargement of the big toe	(6) Grasping power of the big toe for climbing purposes, modified when walking

In the remarkable discoveries and studies of Boule, of Dubois, and of McGregor on the fossilized limb bones of man and in the complementary studies of Schultz in the embryogeny of man, the ape-arboreal-reminiscent hypothesis has not been strengthened; it has, on the contrary, been greatly weakened. The thigh-bone of the Neanderthaloid types resembles that of a man rather than that of an ape; it reveals the erect bipedal, rather than the stooping quadrupedal position. The arms of the Neanderthals are not elongated as they should be according to the ape ancestry hypothesis; they are rather short. The legs of the Neanderthals and of the Trinils are not abbreviated as they should be for the ape ancestry hypothesis; they are decidedly long. Similarly, a superb series of embryonic hands and feet of unborn infants assembled by Schultz do not reveal reminiscences of the attenuated ancestral fingers of an ape-arboreal stage, resembling those of gibbons, chimpanzees, or even of gorillas, but they are short and blunt like modern human hands. The embryonic thumb, similarly, is well developed and reveals no symptoms of recovery from the abbreviated or useless thumb characteristic of all arboreal or branchiating types of primates. Still more, the embryonic big toe, while slightly set apart from the other toes, shows little vestige of former limb-grasping such as is seen in the foot of the anthropoid apes, which is so hand-like as to give the bearer the title *quadrumana,* or four-handed. The human embryonic big toe is set apart like the toes of *Eocene* lemuroids such as the *Notharctus* of Leidy and Gregory.

Comparative and human psychology also weaken rather than strengthen the ape-man hypothesis. The geologic rearrangement of the Piltdown, the Trinil and the Heidelberg races which we owe to recent geologic discovery renders both the Heidelberg and the Piltdown races far more ancient than we had supposed. All the present evidence points to closing Pliocene age for the Piltdown Dawn Man, appropriately named *Eoanthropus* by Smith Woodward. This Dawn Man has a flat vertical forehead like the modern Bushman, a very thick skull, a chimpanzee-like jaw, and a surprising brain capacity of 1,070 cubic centimeters. This brain cube exceeds that of the existing Indian Veddah tribes. As analyzed by Elliot Smith and by Tilney, this Dawn Man has a well convoluted forebrain, speech areas and diversified motor areas for the coordinated motions of the fore limbs, of the hands and of the fingers.

LARGE TERTIARY BRAIN CAPACITY

The Heidelberg race, now recognized as of Lower Pleistocene, is probably a giant pro-Neanderthal, characterized by projecting eyebrows and by a brain which would probably prove to be somewhat inferior in capacity to the more recent Neanderthals. We consequently reach an entirely new estimate of the brain capacity of the human race at the close of Pliocene time and the beginning of Pleistocene time, a period estimated at between 1,250,000 to 1,000,000,000 years before our era.

BRAIN CUBE OF THE NEANDERTHAL AND TRINIL RACES

	Male	*Female*
Neanderthal Caveman of Western Europe:		
La Chapelle aux Saints	1530	.....
La Quina, France	.....	1367
Gibraltar, Spain	.....	1250–1300
Trinil Man of Java (*Pithecanthropus erectus*)	940	.....
Piltdown Man of Sussex, England	1070	.....
Native Indian Veddahs	1000	1040

The Trinil man of Java, *Pithecanthropus erectus* of Dubois, was formerly regarded as of Upper Pliocene, but now it is assigned by Dietrich and Osborn to a more recent geologic age, namely, Middle Pleistocene, since its fossil remains are found associated with stegodontine elephants much more recent in character than those of the Upper Pliocene, such as *Stegodon insignis ganesa*. Meanwhile, the brain of the Trinil man has been shown by Tilney to be distinctly pro-human, with a fairly well-developed forebrain or intelligence area. Consequently, we may now regard *Pithecanthropus erectus* as a very primitive type, a case of arrested development, possibly related to the Neanderthal stock, surviving in the southern sub-tropical forests of Asia, with a brain capacity of 940 ccm.—not far inferior to that of the native Indian Veddahs with a brain capacity of 1,000 ccm.

It required a very long antecedent period to develop the Dawn Man brain capacity and Dawn Man intelligence as demonstrated, in the case of the Piltdown and probably contemporaneous Foxhall races, in the manufacture of many different kinds of small flint implements and in the use of fire. In the case of the Heidelberg race, we observe the manufacture of very large and varied flint implements, such as are found at Cromer on the eastern coast of England and which are believed to be of the same geologic age as the Heidelberg jaw.

Flint tools were, however, by no means the first tools employed by man; they were almost certainly preceded by bone tools of great variety, and bone tools were in turn preceded by wooden tools. Not improbably there was a very long 'age of wood,' then a very long 'age of wood and bone,' followed by a very long 'age of flint' preceding the metal ages. During this enormously long period, which we must now reckon in millions of years, tool-designing and tool-making, the adaptation of tools to certain purposes and needs of life, the use of these tools in offense and defense, in the chase, and in the preparation of food and of clothing laid the foundations of the intelligence of mankind.

HOMINIDÆ (Family of Man)	SIMIIDÆ (Family of Apes)
Pro-human psychology and behavior	*Pro-ape psychology and behavior*
(1) Tool-making capacity of the hands and especially of the thumb	(1) Limb-grasping capacity of the hands and loss of the thumb
(2) Adaptation and design of implements of many kinds in wood, bone and stone	(2) Adaptation of the fore and hind limbs to the art of tree climbing and brachiating
(3) Design and invention directed by an intelligent forebrain	(3) Design limited to the construction of very primitive tree nests
(4) Use of the arms and tools in offense, defense and all the arts of life	(4) Use of the arms chiefly for tree-climbing purposes; secondarily for the prehension of food and grasping of the foe
(5) Use of the legs for walking, running, travel and escape from enemies	(5) Use of legs in tree-climbing and limb-grasping
(6) Escape from enemies by vigilance, flight and concealment	(6) Escape from enemies by retreat through branches of trees
(7) Tree-climbing by embracing the main trunk with the arms and limbs after the manner of the bear	(7) Tree-climbing always along branches, never by embracing the main limbs and trunk

The above are only a fraction of the host of psychic contrasts which might be drawn between the daily behavior of the Dawn Man and the daily behavior of the pro-anthropoid ape. As I have elsewhere summed it up, in the life and conduct of the pro-ape was the potency of the super-apes living to-day—the orang, chimpanzee, gorilla and gibbon—but in the Dawn Man was the potency of modern civilization. The most welcome gift from anthropology to humanity will be the banishment of the myth and bogie of ape-man ancestry and the substitution of a long line of ancestors of our own at the dividing point which separates the terrestrial from the arboreal lines of primates.

It is true that Darwin used the expression, "Man is derived from some member of the Simiidæ," and that the term "ape-man" is deeply engraved in our consciousness, but I claim that it is misleading. The gorilla, chimpanzee and gibbon give us our conception of the ape. I hold that very few of the ape characters were possessed by man in his early stages; they are all characters belonging to an extremely ancient arboreal stage perhaps as ancient as Eocene time. Comparative anatomists find likenesses between apes and man

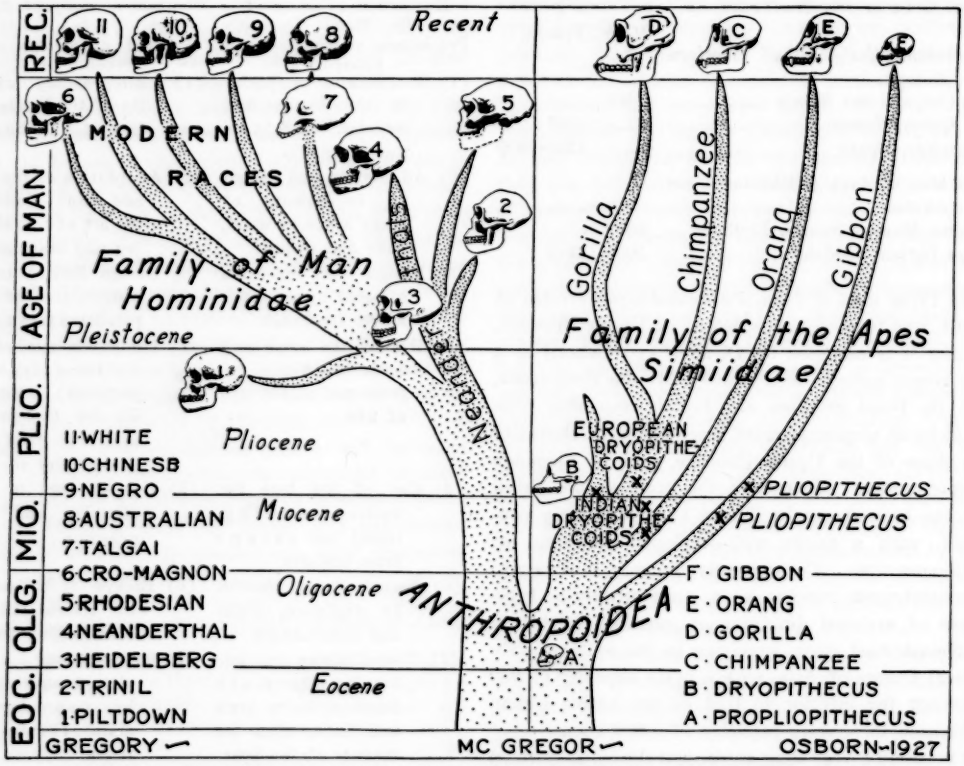

FIGURE 2. RECENT EVIDENCE AS TO THE ASCENT OR PHYLOGENY OF MAN

(LEFT) FAMILY OF MAN, *Hominidæ*, DIVIDING INTO THE NEANDERTHALOID (RIGHT) AND MODERN RACIAL (LEFT) STOCKS. PRESENT GEOLOGIC LOCATION OF THE PILTDOWN, HEIDELBERG, TRINIL, NEANDERTHAL AND RHODESIAN FOSSIL RACES (LEFT). (RIGHT) FAMILY OF THE APES, *Simiidæ*, INCLUDING THE PLIOCENE AND MIOCENE DRYOPITHECOIDS NEAREST THE ANCESTRAL STOCK OF THE *Anthropoidea;* ALSO THE LINES LEADING TO THE GORILLA, ORANG, CHIMPANZEE AND GIBBON. *Anthropoidea*—THE COMMON OLIGOCENE ANCESTORS OF THE *Hominidæ* (LEFT) AND OF THE *Simiidæ* (RIGHT).

by blood tests, osteology and morphology; these characters are strikingly pro-human, and anatomists have dwelt on them to the exclusion of others not human. Between man and the ape—not only the hands and feet of the ape, but the ape as a whole, including its psychology—you will find more differences than resemblances. In brief, man has a bipedal, dexterous, wide-roaming psychology; the ape has a quadrupedal, brachiating, tree-living psychology.

The term "ape-man" has been forced into our language along a number of lines, and even the term "anthropoid" has come to lose its significance. "Ape-man" has gained prestige through early explorers and travelers who represented the anthropoid apes as walking on their hind feet. We have since discovered that no anthropoid ape walks upright; the gibbon balances himself awkwardly when he comes down from the trees, but all the other apes are practically quadrupedal in motion, except possibly in defense, when they rear as a horse would rear. We may therefore eliminate the early descriptions in forming our notions of the anthropoids. A parallel to the misuse of the word "ape-man" would be this: the horse, ass and zebra are so closely related that unless one examines very carefully one can not tell the skeletons apart; they agree more closely than do the anthropoid apes and man. But when we study the habits of the horse, the ass and the zebra we find that each has a totally different psychology: the horse has a forest psychology, the ass has a desert psychology, the zebra has an open-plains psychology. The horse is a splendid swimmer, whereas the mule—a cross between the horse and the ass—has the ass psychology and is afraid of water. It is no more proper to speak of the common ancestor of the apes and of man as "ape-man" than it is to call the common ancestor of the horse and the ass an "ass-horse." Another instance of wide psychic difference between like animals is

that of the black and the white rhinoceros of Africa, which have a very dissimilar psychology and react differently in every emergency.

EMPIRE OF THE LOW-BROWED NEANDERTHAL RACES

We may class together as Neanderthaloid all the prehistoric races with prominently projecting supra-orbital processes; with low, retreating foreheads; with correspondingly low, broad type of brain, especially with low forebrain in contrast with the relatively high forebrain of the Piltdown and of modern races; with massive jaw and retreating chin of the Heidelberg and true Neanderthal type. The increasing brain power of these Neanderthaloids during Pleistocene time is perhaps measured by contrast between the Trinil brain of 940 cubic centimeters and the most highly developed Neanderthal brain of 1,530 cubic centimeters. The psychology of this race is further revealed by the prevailing type of flint implement, of offense and defense, of the chase and in the preparation of food. The first of these great Neanderthal flint types is found in the Cromer deposits in East Anglia—tremendous flint implements used largely in combat. Over an enormously prolonged period these implements passed through Cromerian, pre-Chellean, Chellean, Acheulean and, finally, Mousterian stages, wherein they begin to show decadence and loss of virility, together with invasion of other types of implements.

The great Neanderthaloid race, with its characteristic stone culture, apparently dominated North Africa and all of Europe and extended eastward into the heart of Asia. Its quarries and camping grounds increase in number as Pleistocene time goes on, and an eastward to southward spread may be represented in the recent discoveries of Mousterian camping sites in Ordos, China, and of a Neanderthaloid skull, which has been named the Rhodesian skull, at Broken Hill Mine, South Africa. The animal life contemporaneous with this race is well known; it included a large variety of elephants, chiefly of the southern and straight-tusked types, rhinoceroses and, in the lower lands, hippopotami. This is known as a South Temperate fauna adapted to rather fertile lands, river bottoms and abundant forests. In such an environment game was so plentiful that there was relatively little struggle for existence, hence there was little incentive to the development of a diversified flint industry. Superior intelligence was not demanded and it is therefore surprising that under these circumstances the Neanderthal brain attained the dimensions which threw even the genius of Huxley off the track as to the very primitive character of this race. Taken altogether, the widely extending range of the Neanderthaloid races is one of the most firmly established facts of prehistory. If our geologic time scale is reliable, it extended over a period of 900,000 years, and if our present records of quarry grounds and implements are reliable, the Neanderthals had almost exclusive possession of an enormous territory.

THEORY OF THE NORTH EURASIATIC ORIGIN OF THE HIGH-BROWED RACES

It was formerly believed by certain anthropologists that the Neanderthals were the progenitors of the succeeding higher races, but in my opinion we may entirely abandon this theory and substitute a theory of the complete replacement of the Neanderthal empire by invading races that had acquired superior intelligence under entirely different conditions of life. In other words, while the Neanderthals were enjoying exclusive possession of Central Europe, Asia and a large part of Northern Africa and were spreading southward into Rhodesia, the progenitors of all the modern races were occupying another great area, under conditions of life in which the struggle for existence was much more severe and in which there were far greater demands upon the native wit of man to overcome natural difficulties by invention and resourcefulness.

This unexplored territory, the unknown homeland of the higher races of man, can not be south of the Neanderthal Eurasiatic belt, because to the south conditions of life were less rigorous, food was more easily obtained, and the milder sub-tropical climate was less stimulating to discovery and invention. In this southern, less stimulating region of Eurasia may have survived the persistent Trinil race of Java and other primitive races still undiscovered. To the south, in Africa, may also have developed Negroid stock under Central African conditions of life that must closely parallel those of Central and Southern Eurasia during the great Neanderthal period.

Consequently, it is to the northern regions of Eurasia that we must look for the unknown homeland of the higher races, to a temperate and north temperate region which extended along the northern borders of the Neanderthal empire over the high central plateau region of Asia, over the great plains region to the north of the central plateau and, finally, over the confines of eastern Europe. It may be laid down as a fixed principle in the rise of the intelligence of man that only when the struggle for existence is fairly keen does any race progress; when the struggle for existence is too severe the entire life is devoted to physical support, to the exclusion of intellectual and social progress.

The new modern races, pure and blended— Mediterranean long-heads, Alpine broad-heads, blended Cro-Magnons, Nordics—apparently moved eastward

over this northerly plateau and plains region and finally subdued the entire Central Eurasiatic empire of the Neanderthals. These new races were not only distinguished by large brains and by equal powers of observation, of reasoning, of design, of tool-making, and of social, moral and political organization, but were also endowed with higher intellectual, spiritual and creative faculties which gave them both physical and intellectual supremacy over the Neanderthals and led to their entire occupation of western Europe. First, to measure their capacity purely by the cube of their brain, let us place these nearly arrived races in order of brain power with the existing races, high and low:

	Cube of Brain Capacity		
	Male	Female	Maximum
Cro-Magnon Caveman of Mentone	1550	.....	1590
Average modern European	1450	1300	.....
Average modern Swiss	1200	1230	1660
Upper Palæolithic broad-head race of Ofnet	1400	.....	.....
Living broad-head race of Czechoslovakia	1230	1000	1800
Native Australian race	1310	1154	.....
Native Indian Veddahs	1000	1040	1400
Papuans of New Guinea	1236	1125	.....

The Cro-Magnons, who have been termed the Palaeolithic Greeks, rank extremely high in their cubic brain capacity; they entered Europe side by side with the pure long-headed and broad-headed races, also of high brain power, and are now considered to represent a blend between long-heads and broad-heads. Imagine the enormously long period of time during which this very high modern brain power developed and consider through the astonishing industry and diversified art of these people that every faculty has its cerebral equivalent and ancestry for each of its several coefficients. The extreme accuracy of observation of animal form displayed by the Cro-Magnons is not the result of hundreds of years, but of hundreds of thousands of years.

It is possible that the Piltdown race of Upper Pliocene time with its 1,070 ccm. brain cube is an offshoot of the precociously large-brained stock that gave rise to the group of modern races—Australoid, Negroid, Mongoloid, Caucasian. Yet the Piltdown race has a chimpanzee or anthropoid ape type of jaw. It seems a very hazardous prediction, but I am inclined to anticipate the discovery, even in Pliocene time, of a modernized type of jaw with prominent chin. This is against all existing evidence, with the exception of the dubious Foxhall jaw with its prominent chin, for all the known Pliocene and early Pleistocene races have a sloping chin or less remotely resemble the anthropoid ape type.

CONCLUSION

Let us therefore conclude with consideration of the ancestry of man according to the modified concept of "dawn men," not "ape-men." In the first place, over an incredibly long period of time the Dawn Men have been tool-makers, of high adaptability and wonderful technique. We have then a biped, a being with a hand capable of grasping and controlling tools, a tool-maker with as fine a sense of touch as that of any of the present-day etchers, engravers and artists. In my opinion, the pro-man psychology, leaving out the evidence of anatomy and morphology, is certainly that of a Dawn Man and not of an "ape-man." I agree with my colleagues that man passed through an arboreal stage, but I believe that this stage did not progress so far as to carry man into a stage approaching that of the anthropoid apes. Dollo has stated the law of the irreversibility of evolution. The brachiating hand of the ape was used as a hook—apes do not grasp a branch with the fingers and thumb but hook the whole hand over the branch, as trapeze workers do to-day—and the thumb was therefore a grave danger. If man had gone through a prolonged period of brachiating in the branches of trees he would have lost his thumb. I agree to putting our arboreal ancestors back to Eocene time, but I predict that even in Upper Oligocene time we shall find pro-men, and if we find Oligocene pro-man—in Mongolia, for example—that he will have pro-human limbs, not pro-anthropoid ape limbs.

Of all incomprehensible things in the universe man stands in the front rank, and of all incomprehensible things in man the supreme difficulty centers in the human brain, intelligence, memory, aspirations, and powers of discovery, research and the conquest of obstacles. The approach to this unknown field of future human advance—the seat of the human mind and the constitution of the human mind—is along the great paths of human and comparative anatomy and of human and comparative psychology and behavior. Yet this approach will yield only a tentative conclusion; the final solution of this problem of problems—the rise of man—will come only through unremitting exploration and the chance finding somewhere in the Eurasiatic continent of actual fossil remains of the Oligocene pro-man, of the Miocene and Pliocene Dawn Man and, finally, of the early Pleistocene ancestors of the large-brained modern races.

HENRY FAIRFIELD OSBORN
AMERICAN MUSEUM OF NATURAL HISTORY

NOMENCLATURAL EFFICIENCY

THE economic bearings of nomenclature have been touched upon by Prof. C. W. Stiles, of the U. S. Public Health Service, in the issue of SCIENCE for February 25. No one can take exception to his plea for greater efficiency in nomenclature or to his suggestion that students be given instruction in regard to such matters.

It seems fitting in this connection to briefly summarize present conditions. Our system was proposed by Linnaeus, and doubtless in his day he was regarded as something of a nomenclatural heretic. The system has rendered admirable service and at the time it was proposed met every reasonable need. In those days, general zoologists were doing most of the work, describing species, building up nomenclature and all possessed a somewhat comprehensive viewpoint of the situation as a whole. To-day so far as active contribution to nomenclature is concerned, the general zoologist exercises a comparatively small influence and is mostly limited to passing upon questions of priority, general validity and taxonomic values with occasional dissertations upon the necessity of deriving generic names from the Greek and expressions of dissatisfaction at departures from this somewhat well-established procedure. The genera of the present day, the fundamental units in our system, are being proposed in large numbers mostly by specialists, some of whom at least are more concerned in securing diversity than in the effect the name proposed may have upon classification as a whole. In other words, the rather inexperienced men in general nomenclature are making most of the additions, while zoologists as a whole ignore the ascendency of the specialist, something entirely unsought in most cases, and insist that all generic names must be considered as a part of a large unchangeable whole in a world where stability is unknown. The law of priority is invoked as the stable feature of the system, and no restrictions whatsoever are laid upon the proposer of new names, save that he must see or think that he sees some form worthy of generic rank. Any combination of letters, significant or otherwise, short, long or unreasonable polysyllabic conglomerations are all acceptable, provided they have not been duplicated by any one else throughout the entire zoological series. There are cases where naturalists have proposed extremely long names simply to lessen the probability of creating a homonym, and in some instances the selection of a generic name has been prompted by a sense of satire rather than consideration for the system as a whole. This uncontrolled and to a certain extent irresponsible extension of nomenclature has continued for 175 years with little suggestion as to changes for the better, in the larger sense, at least.

It must be admitted at the outset that nomenclature is not an end in itself. It is presumably an aid to classification and therefore efficiency in the broadest possible sense should be the chief criterion. The system was not created to honor earlier workers, even though they have made large and valuable additions to knowledge as a whole. Nomenclature is not an exercise in Greek or a test for memory; it is or should be a tool to assist in the ready placement of the long series of species with which the naturalist is compelled to deal. With this clearly in mind, and remembering also that a very large proportion of our concepts, which we instinctively associate with generic names, are based almost entirely upon association, and to a very slight extent upon the significance of the name itself, we may well inquire whether our system of nomenclature is the efficient tool that it might be, and whether it is a credit to the organizing ability and acumen of the zoologists who have been responsible for its development. This is not a reflection upon earlier taxonomists. It is simply a statement of facts deserving most careful consideration.

The system is faulty in a number of respects. We would emphasize the following points in a summary of present conditions:

(1) The long and constantly increasing series of generic names, now some 160,000, possess little definitive value in themselves.

(2) Dependence for taxonomic significance in generic names is largely upon the position of the name in the systematic list or other work of a general character.

(3) A scrutiny of generic lists shows thousands of homonyms, many of which should have been avoidable.

(4) Zoologists generally have failed to take advantage of the superior classifying and placing value of the initial syllables in names.

(5) The short prefixes have been grossly abused by indiscriminate, unintelligent use.

(6) There has been no serious attempt, aside from a few proposals to be mentioned below, to take advantage of the possibilities of comprehensive placing systems.

(7) Zoologists as a whole have invoked the law of priority as the one stable feature in a system where stability is impossible, though recognition of priority is decidedly helpful.

(8) We have an exceedingly complex system to which nearly unrestricted, unregulated additions are made by practically independent workers throughout the world.

A very curious condition prevails at the present time. There is a general feeling that our system of nomenclature is stable, is satisfactory and should not be modified on account of the ill effects following any such change, and yet most scientists are changing generic concepts with their transfer of species, re-erecting under the law of priority older and forgotten names, and our International Commission on Zoological Nomenclature is wrestling with very abstruse problems and issuing from time to time official lists of generic names, which may remain in an accepted class for a decade, generation or longer. The relation between problems solved and those created is possibly one to ten. We are trying, as it were, to swim up stream against a strong current. The situation is such that some economic entomologists at least have felt that the despised and supposedly unstable common names were more reliable than the presumably superior scientific names, which have from time to time been applied to economic species. There is not a more instructive work for the man interested in nomenclature than Sherborn's "Index Animalium," with its lists of hundreds of species referred to various genera in earlier years and now widely scattered under other designations. Only a glance is sufficient to suggest the enormous amount of time which has been spent working out synonymy and referring these various species from genus to genus. It is the opinion of the writer that more time has been spent upon this relatively useless and to a large extent avoidable activity than would have been necessary to recast our entire system of generic names in a logical manner to accord with modern methods of classification or placing devices.

No one can deny the value of regulated diversity, provided it does not place intolerable restrictions upon individual workers. Why not recognize the fact that we are at present traveling toward greater confusion and loss of efficiency simply because, following the law of inertia, we have held that the methods of a hundred years ago are "good enough" and no one has dared to tackle this large proposition in a comprehensive manner? Should we not recognize the situation as it is and endeavor to find a practical solution for present difficulties? Some blame the inadequacy of our nomenclatural system upon the diversity of life itself and in a measure admit their inability to reach a successful solution.

Think for a moment of the opinion we would form if a business or political unit were to establish a comprehensive classification, and then turn it over without restriction to subordinates in all parts of the world. Chaos would speedily result, unless the organization maintained a certain measure of supervision, and if one were to go into business houses, he would be very apt to find a system of letters or numerals imposing a fairly accurate classification upon the various branches of the business. Compare the above with our present system or lack of system! No one to-day advocates the methods of one hundred or two hundred years ago in transportation, communication and the like, and why should we assume that a change for the better can not and should not be made in relation to nomenclature?

The practical advantages of systematically diversified generic names are indicated by the somewhat general employment in various groups of short and characteristic combinations as suffixes, and occasionally as prefixes, for related genera. For example, among the mammals there are some 348 genera with the combination mys, mouse, and 268 with nycteris, bat, and in insects a number of similar cases may be readily cited, such as thrips in 256 genera; termes in 121 genera; diplosis in over 100 and psylla or psyllus in some 99 genera. Similarity in generic names for related forms is certainly a great assistance, and the unfortunate condition in relation to those listed above, and numerous others to be found throughout the entire animal series, is that they have not been systematically applied.

The need of systematic diversity in our zoological names has been recognized by various individuals, and several proposals have been made, none of which have been adopted, largely on account of the conservative attitude toward changes in nomenclature, and presumably in some instances at least on account of the new methods not solving the problems in a satisfactory manner. One of the earliest was that of Professor Harting[1] in which he proposes a system of class suffixes combined with ordinal prefixes. The use of letter formulae for kingdom, phylum, class, order and genus and numerals for species was proposed by Tornier[2] for both animals and plants. The use of prefixes and suffixes for the ready placing of generic names of animals and plants was proposed by Herrera[3] and a series of initial letters for classes and ordinal prefixes by Rhumbler.[4] Jonathan Dwight, Jr.,[5] and Professor James G. Needham[6] both make pleas for a more logical nomenclature. Dr. Heikertinger gives a somewhat extended discussion of the possibilities of prefixes and suffixes.[7] A more recent and in certain respects, at least, a more com-

[1] *Archiv. f. Naturgesch.*, 1: 26–41, 1871.
[2] *Zoologischer Anzeiger*, 21: 575–580, 1898.
[3] SCIENCE, 10: 120–121, 1899.
[4] *Zoologischer Anzeiger*, 36: 453–471, 1910.
[5] SCIENCE, 30: 526–527, 1909.
[6] SCIENCE, 32: 295–300, 1910.
[7] *Zoologischer Anzeiger*, 47: 198–208, 1916; 50: 41–54, 299–302, 1918–1919.

prehensive system has been outlined by Felt and Bishop[8] in which code prefixes are proposed, these latter to have nomenclatural and differential status, to be written as a part of the generic name, save that the latter is also capitalized; they would therefore function as taxonomical classifying devices and thus facilitate the work of specialists by making it necessary to examine only the names in a given family or larger group before proposing a new genus, and this without material interference with the status of the genus as to date of erection, type and author or transferal from one family, order, class or phylum to another.

It should be assumed that the proposals outlined above were made for the purpose of bettering nomenclatural conditions. No one of them probably includes all that is best or acceptable. They all emphasize, however, the need of a systematic nomenclature and that can not be secured without more restrictions than now obtain. It is here suggested that our leading zoologists, particularly those interested in nomenclature, and this should really include all zoologists, give serious consideration to this entire matter and endeavor to work out, very probably through the International Commission on Zoological Nomenclature or a committee appointed by that commission, a method of more nearly meeting present-day needs than the one now current. This would mean a large amount of labor. It should be entirely possible first to establish within certain basic divisions such modifications as might be necessary, though a comprehensive presentation covering the entire animal group would be more satisfactory and entirely within possibilities. It may be stated in this connection that the writer has applied code prefixes under the name of classifying symbols to all the families of American insects and is using the system in arranging the New York State Collection of Insects. The precise plan adopted is not so important as to secure a material change for the better, one reasonably consonant with modern classificatory or placing methods. Objectors may claim that zoological classification has not advanced sufficiently to permit the adoption of a general plan. There is no greater aid to understanding than an effort to group logically the various components of a series. Several of our associates have expressed themselves in favor of a better system and have stated that a change should have been made years ago. Many of the older zoologists undoubtedly feel rather well satisfied with the present system, because it is the one which they have known for years. Efficiency should be the final test and if this generation fails to hand down a satisfactory terminology, it is well within possibilities that a succeeding generation, possibly driven to action by confusion worse confounded, may adopt such radical changes that our present nomenclature will become an historical relic. Mere age is no reflection. Linnaeus were he alive to-day would undoubtedly propose a system more nearly adequate to present needs.

The suggestion by Professor Stiles that there be a custodian, as it were, of zoological nomenclature has merit, though it lacks desirable comprehensiveness so far as meeting the situation as a whole is concerned. There is something in Professor Needham's plea for a better "way of disposing of our nomenclatural trouble than by making it as burdensome as possible and then making it permanent."[9] It is not enough simply to avoid homonyms. There is urgent need of some adequate differential or classifying device as part of the generic name before we can claim reasonable efficiency in nomenclature. A careful reading of the numbered paragraphs shows that improvement is possible. It may even be admitted that action along progressive lines is posterity's due.

E. P. FELT,
State Entomologist
NEW YORK STATE MUSEUM

[8] *American Naturalist*, 60: 275–281, 1926.

[9] SCIENCE, 32: 296, 1910.

SCIENTIFIC EVENTS

MEMORIAL SERVICES TO CHARLES D. WALCOTT

IN commemoration of the life and achievements of Dr. Charles D. Walcott, memorial services were held at a number of educational institutions in the Pacific Northwest on or near the date of March 31. This particular date was chosen because it was Dr. Walcott's birthday.

The movement was initiated by the officers and council of the Northwest Scientific Association and meetings were held at the following places: Montana State University, Missoula; Montana State College, Bozeman; Montana State School of Mines, Butte; Idaho State University, Moscow; State Normal School, Lewiston, Idaho; Oregon Agricultural College, Corvallis; Washington State University, Seattle; Washington State College, Pullman; Washington State Normal School, Ellensburg; Washington State Normal School, Bellingham; Washington State Normal School, Cheney; Gonzaga University, Spokane University, Spokane College and Whitworth College, all of Spokane, Washington.

In addition to these services a joint service was held in Spokane, Washington, in which the following organizations participated: Eastern Washington His-

torical Society, Associated Engineers of Spokane, Lewis and Clark High School, North Central High School and the members of the Northwest Scientific Association residing in Spokane.

J. W. HUNGATE

CHENEY, WASH.

ACTIVITIES OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THE trustees of the American Museum of Natural History, at their quarterly meeting on May 2, adopted a resolution accepting an invitation from the Belgian government to cooperate in the latter's plans for research work and scientific development in the study of wild animal life in the Belgian Congo, Africa. The resolution expressed appreciation of the action taken by King Albert of the Belgians in authorizing the setting aside of a vast area as a game preserve. Baron de Cartier, Belgian ambassador to the United States, recently made known his government's plans, and the museum intends to organize American scientific cooperation.

Harold E. Anthony, Curator of Mammals at the museum, who accompanied the Egyptian-Sudan expedition, financed by Irving K. Taylor, which left New York last December, reported that the expedition had obtained about 200 mammals, 400 birds and some fish and reptiles, which have been brought back to the museum. The mammals include buffalo, hartebeeste, water-buck, cob, oribi and gazelles.

A resolution was adopted to name the proposed African Hall section of the Museum the Akeley African Hall, as a memorial to the late Carl E. Akeley. It was announced that all the material collected by the Eastman-Pomeroy-Akeley expedition has been received at the museum, including buffalo, greater kodoo, lesser kodoo, water hole, plains and wild dog groups.

Mr. and Mrs. Martin Johnson, who have been in Africa several years photographing wild life, will arrive in New York the latter part of May, and they will show their films during the early fall. Arthur S. Vernay, who has previously obtained specimens of the rapidly vanishing big game of India for the museum, has contributed a greater sable antelope group for the African hall.

Lincoln J. Ellsworth was elected a trustee.

MEETING OF SIGMA XI AND DEDICATION OF THE NEW PHYSICS LABORATORY AT UNION COLLEGE

THE national executive committee of Sigma Xi held its annual business meetings on April 29 and 30, at Schenectady, New York. On the evening of the twenty-ninth, the chapter of Union College and the chapter of Rensselaer Polytechnic Institute, which are the two oldest chapters of Sigma Xi next to the parent chapter at Cornell University, joined in giving a dinner in honor of the members of the executive committee. Two hundred members of Sigma Xi from the Capital District were present for the occasion. The meeting was presided over jointly by Professor L. W. Clark, president of the Rensselaer chapter, and Professor P. I. Wold, president of the Union chapter. Among the speakers of the evening were Dr. Frank Pierrepont Graves, commissioner of education of the state of New York, who gave an address on "Sigma Xi and Education"; Dr. Henry B. Ward, University of Illinois, past president of Sigma Xi, speaking on "Animal Parasites and Human Welfare"; Dr. F. K. Richtmyer, Cornell University, past president of Sigma Xi, speaking on "The Meaning of 'Wave Length' in Theories of Radiation," and Dr. George A. Baitsell, Yale University, speaking on "Coagulation Phenomena in relation to Tissue Formation."

A message from Governor Alfred Smith was received during the dinner reciting the accomplishments of science in the affairs of this country, and of the state in particular, and expressing the hope and confidence that Sigma Xi would continue doing her share in the future.

It was agreed by all those present that the meeting was one of the most enjoyable Sigma Xi events which has ever occurred in this section of New York State and it should go a long way toward stimulating increased interest in Sigma Xi on the part of members and non-members in the Capital District.

Dedication of the new Physics Laboratory at Union College took place on April 30, 1927, in the Lecture Room of the new building, with the following program:

Dr. E. W. Rice, Jr., presiding.
Invocation by Rev. George Alexander, New York City.
Professor P. I. Wold, on behalf of the physics department.
President C. A. Richmond, on behalf of the college.
Dr. W. R. Whitney, on behalf of the trustees of the college.
Professor F. R. Moulton, University of Chicago.

Dr. Moulton, in giving the main address of the exercises, spoke on the subject of "Science and Civilization," giving a philosophical consideration of the question of the adaptability of the human race and the problems facing future generations, in the light of the revolutionary changes in our methods of living brought on by science during the past two or three generations.

After the program a buffet luncheon was served and the building was opened for inspection.

P. I. W.

ELECTIONS OF THE AMERICAN ACADEMY OF ARTS AND SCIENCES

AT the annual meeting of the American Academy of Arts and Sciences the following were elected foreign honorary members:

Francis Crawford Burkitt, of Cambridge, England
Henry Hallett Dale, of London
Peter Debye, of Zurich
Léon Duguit, of Bordeaux
Willem Einthoven, of Leyden
Ejnar Hertzsprung, of Leyden
Vincent d'Indy, of Paris
Victor Laloux, of Paris
Friedrich von Mueller, of Munich
Gilbert Murray, of Oxford
Henri Rabaud, of Paris
Josef Redlich, of Vienna
Richard Wettstein, of Vienna

At the same time the active membership of the academy was increased by the admission of thirty-five fellows. These are:

Kenneth Daniel Blackfan, of Brookline
Robert Pierpont Blake, of Cambridge
George Whitefield Chadwick, of Boston
William John Crozier, of Cambridge
Philip Drinker, of Brookline
Gordon Maskew Fair, of Cambridge
William Cameron Forbes, of Norwood
James Lawder Gamble, of Brookline
Wallace Goodrich, of Boston
Harvey Monroe Hall, of Berkeley
Arthur Norman Holcombe, of Cambridge
Earnest Albert Hooton, of Cambridge
Charles Hopkinson, of Manchester
Percy Rogers Howe, of Boston
Ivan Murray Johnston, of Cambridge
Alfred Vincent Kidder, of Andover
Donald Hamilton McLaughlin, of Cambridge
James Howard Means, of Boston
Axel Leonard Melander, of New York
George James Peirce, of Stanford University, Calif.
Frederick Haven Pratt, of Dedham
Joseph Hersey Pratt, of Boston
Edwin Arlington Robinson, of New York
Allan Winter Rowe, of Boston
George Sarton, of Cambridge
Andrew Watson Sellards, of Brookline
John Clarke Slater, of Cambridge
Willard Learoyd Sperry, of Cambridge
Harlan True Stetson, of Cambridge
Edmund C. Tarbell, of Boston
Langdon Warner, of Cambridge
Joseph Treloar Wearn, of Boston
Robert Spurr Weston, of Boston
Westel Woodbury Willoughby, of Baltimore
Quincy Wright, of Chicago

One associate was elected: Nathaniel T. Kidder, of Milton. The officers chosen for the year 1927–28 are:

President: EDWIN B. WILSON
Vice-president for Class I: ARTHUR E. KENNELLY
Vice-president for Class II: GEORGE H. PARKER
Vice-president for Class III: GEORGE L. KITTREDGE
Corresponding Secretary: ROBERT P. BIGELOW
Recording Secretary: CHARLES B. GULICK
Treasurer: INGERSOLL BOWDITCH
Librarian: HARRY M. GOODWIN
Editor: WILLIAM S. FRANKLIN

THE MEDAL MEETING OF THE FRANKLIN INSTITUTE

THE Medal Meeting of the Franklin Institute, Philadelphia, was held on Wednesday afternoon, May 18. Presentation of medals was made according to the following program:

Longstreth medals to Mr. Wilfred Lewis, of the Tabor Manufacturing Company, and Mr. James F. Smathers, Smathers Power Typewriting Company.

The Wetherill medal to North East Appliances, Inc., with special mention of Mr. Russell G. Thompson.

The Levy medal to Dr. William David Coolidge, of the General Electric Company.

Potts medals to George Earle Beggs, associate professor of civil engineering, Princeton University, and Commander Marion Eppley, of the Eppley Scientific Laboratories.

Cresson medals to Dr. Edward Leamington Nichols, professor emeritus of physics, Cornell University, and Dr. Dayton Clarence Miller, research professor of physics, Case School of Applied Science.

The Franklin medal and certificate of honorary membership to Professor Max Planck, of the University of Berlin. Received by the Counselor of Embassy, Dr. O. C. Kiep, the German Embassy, Washington, D. C.

The Franklin medal and certificate of honorary membership to Dr. George Ellery Hale, honorary director, Mt. Wilson Observatory. Received by Dr. Harlow Shapley, professor of astronomy and director of the Harvard College Observatory, Harvard University.

After the presentation of the medals the following papers were read:

"The Physical Reality of Light Quanta," by Professor Max Planck. Presented by Professor T. D. Cope, University of Pennsylvania.

"The Sun as a Research Laboratory," by Dr. George Ellery Hale. Presented by Professor Harlow Shapley, Harvard University.

SCIENTIFIC NOTES AND NEWS

DR. GEORGE H. F. NUTTALL, professor of parasitology in the University of Cambridge, has been made professor, *honoris causa*, in the University of Strasbourg.

AN honorary doctorate of law was conferred upon Dr. A. F. Joffe, director of the Institute of Physics in Leningrad, by the University of California at the commencement exercises on May 11.

RALPH MODJESKI, civil engineer of Chicago, will receive the degree of doctor of engineering on June 15 at the annual commencement of the Pennsylvania Military College.

DR. FRANK BILLINGS, emeritus professor of medicine at the University of Chicago, has been decorated with the legion of honor by the French government.

THE American Society for Testing Materials has elected Robert W. Lesley, William R. Webster and A. A. Stevenson honorary members of the society. The formal presentation of certificates of honorary membership will be made at the anniversary dinner in connection with the June meeting at French Lick, Ind.

THE following visiting professors at Cornell University have been elected members of the Cornell Chapter of Sigma Xi: Dr. A. V. Hill, of the University of London; Dr. W. H. Pearsall, of the University of Leeds, and Dr. Otto Rahn, of the University of Kiel.

ON April 12 the King of Denmark and Iceland conferred on Austin H. Clark and on Adam Giede Böving, both of the Smithsonian Institution, the Cross as a Knight of the Order of Dannebrog in recognition of their services to Danish science and to Danish scientific institutions.

ALEXANDER F. BUCHOLTZ, research assistant at the Missouri Botanical Garden, has been elected a member of the German Botanical Society.

FRIENDS of Dr. Edward N. Brush, Mount Washington, superintendent emeritus of the Sheppard and Enoch Pratt Hospital, Baltimore, attended a dinner at the Maryland Club on April 23, given by the trustees of the hospital to celebrate his seventy-fifth birthday. Dr. Brush is editor-in-chief of the *American Journal of Psychiatry*.

AT the annual meeting of the Boston Society of Natural History, held on May 4, the Walker prizes in natural history were awarded as follows: a first prize of sixty dollars to J. B. Looper, of the University of Virginia, for a manuscript entitled "Observations on the Food Reactions of *Actinophrys sol*"; a second prize of fifty dollars to Miss Edith W. Mank, Lawrence, Mass., for a manuscript entitled "The Life History of *Baris scolopacea* Germ." At this meeting all the present officers of the society were reelected, as follows: *President,* Thomas Barbour; *vice-presidents,* Nathaniel T. Kidder, William M. Wheeler and Frederic T. Lewis; *secretary,* Francis Harper; *treasurer,* William A. Jeffries; *trustees,* Joseph A. Cushman, Laurence B. Fletcher, Frederic H. Kennard, W. Gordon Means, John C. Phillips and Charles H. Taylor.

DR. CHARLES J. WHITE has resigned as Edward Wigglesworth professor of dermatology at the Harvard Medical School and will become professor emeritus. He has taught at the school since 1898.

THE following officers were elected at the annual meeting of the Society for Experimental Biology and Medicine, held at the City College of New York, on April 20: *President,* S. R. Benedict, Cornell University Medical College; *vice-president,* Peyton Rous, Rockefeller Institute; *secretary-treasurer,* A. J. Goldforb, City College of New York; *new councillors,* H. D. Senior, Bellevue Medical College, and Alfred E. Cohn, Rockefeller Institute.

AT the recent Philadelphia meeting of the American Electrochemical Society the following officers were elected: *President,* Professor S. C. Lind, of Minnesota; *vice-presidents,* Dr. Duncan McRae, head of the Guggenheim Research Laboratories, P. J. Kruesi, president of the Southern Ferro Alloys Co., Chattanooga, Robert Turnbull, consulting engineer, Niagara Falls; *managers,* O. C. Ralston, Bureau of Mines, R. L. Baldwin, Niagara Falls, H. C. Cooper, Chicago; *treasurer,* Acheson Smith, Niagara Falls; *secretary,* Colin G. Fink. Columbia University, New York.

H. T. TIZARD has been appointed successor to Sir Frank Heath as secretary of the committee of the British Privy Council for Scientific and Industrial Research.

DR. HENRY HALLETT DALE, F.R.S., has been appointed to be for five years a member of the general council of medical education and registration in the United Kingdom, in succession to Sir Nestor I. C. Tirard.

DR. W. O. FISCHER, since 1919 engaged in research work with Bayer 205 in the Congo, Africa, has been appointed special medical research officer to the Rand Mines; Dr. Fischer has a laboratory at City Deep, and his initial investigation has been on hookworm in mine natives.

EDWIN H. BRYAN, JR., formerly entomologist on the staff of Bishop Museum, has succeeded Dr. Stanley C. Ball, as curator of collections.

DR. THOMAS C. WHITNER, Jr., associate in chemistry at the Johns Hopkins University, has been appointed chemist in the research department of the Standard Oil Company.

DR. O. C. MAGISTAD, soil chemist for a commercial fruit company in Honduras, has been appointed associate professor of agricultural chemistry at the University of Arizona and associate chemist in the experiment station.

A RESEARCH table at the Zoological Station at Naples, Italy, has been awarded to Dr. Mathilde Margarethe Lange, associate professor of zoology at Wheaton College, by the Association to Aid Scientific Research among Women.

DR. CHARLES F. ADAMS, Chicago, has been made director of the Indiana state bacteriologic laboratory, to succeed Dr. Thurman B. Rice, who resigned several months ago.

WALTER W. TUPPER, assistant professor of botany at the University of Michigan, has sabbatical leave of absence from that university for the second half of the current academic year and is working at Yale University on the microscopic structure of tropical woods.

DR. WARREN C. HUNTER has resumed his work at the University of Oregon School of Medicine, having returned from a leave of absence spent at the University of Michigan in the completion of a fellowship with the National Research Council in the department of pathology under Dr. A. S. Warthin.

DR. WARDLE, lecturer in economic zoology at the University of Manchester, has been granted leave of absence for the coming year and will offer advanced and graduate courses in the division of entomology of the University of Minnesota.

DR. HARRY N. EATON, of the department of geology of Syracuse University, is on sabbatic leave in Utah with headquarters at Provo, where he is investigating the structure and physiographic history of some of the smaller Utah mountain ranges, and is collaborating in part with Dr. Murray O. Hayes, of Brigham Young University.

STANLEY F. MORSE, consulting agricultural engineer, who recently returned from an inspection trip to British Guiana, sailed on May 12 for Colombia, South America. Mr. Morse will make an agricultural survey of a new region in the Department of the Cauca Valley.

C. W. BOYCE, of the office of forest economics of the U. S. Forest Service, has been awarded a Sterling fellowship at Yale University for the next school year and will be granted leave of absence beginning next October.

DR. KNIGHT DUNLAP, professor of psychology at the Johns Hopkins University, has been granted a year's leave of absence to serve as chairman of the division of anthropology and psychology of the National Research Council in Washington. During the first half of next year Dr. Karl Buehler, professor of psychology in the University of Vienna, will take Dr. Dunlap's place. Dr. John Edgar Coover, of Leland Stanford University, California, will lecture in his stead during the second half year.

DR. VENING MEINESZ, engineer of the Dutch geodetic commission, has returned to his home in Holland after completing a voyage on a submarine from Holland to Java, by way of the Panama Canal. During the voyage he made observations for gravity determinations. After arriving at Java he made a short voyage into the Indian Ocean on his submarine and made further gravity observations.

PROFESSOR HERMANN LUDWIG WINTZ, director of the gynecological clinic at Erlangen, has been invited by the Radiological Society of North America to deliver addresses before several American universities on the X-ray treatment of carcinoma.

SIR CHARLES S. SHERRINGTON, Waynflete professor of physiology at Oxford University, will give the second Listerian oration of the Canadian Medical Association on June 17. The association meets in Toronto from June 13 to 18.

ON April 30, Professor J. J. R. Macleod, of the department of physiology in the University of Toronto, delivered an address before the Royal Canadian Institute, on the subject "Lister as a Scientist."

DR. FREDERICH VON MUELLER, professor of internal medicine at the University of Munich, has been invited to give two lectures in Copenhagen by the Danish Society of Internal Medicine. The lectures are supported by the Rask-Oersted fund.

PROFESSOR JAMES KENDALL, of the department of chemistry at the Washington Square College of New York University, addressed the Chicago section of the American Chemical Society on April 22 on "Separations by the Ionic Migration Method." The same lecture, together with a more informal talk on "The Abuse of Water," was delivered at Wellesley College on May 6.

A TALK by Dr. Arthur D. Little on "Important Research Problems of To-day" was presented at the Polytechnic Institute at Brooklyn, N. Y., on the evening of May 3 and was broadcast through Station WNYC. A similar talk was given the next day to day students of the institute.

PROFESSOR G. W. STEWART, of the State University of Iowa, recently gave to the graduate students in communication engineering at Yale University a

series of twelve lectures on various phases of acoustic phenomena.

A LECTURE on "Physiological Research Institutions of Europe" was recently given at the University of New Hampshire by Dr. Francis G. Benedict, director of the Nutrition Laboratory of the Carnegie Institution of Washington, Boston.

DR. EDGAR ALLEN, professor of anatomy at the University of Missouri, addressed the science club of the Kansas State Agricultural College on the subject, "Endocrinology, with Special Emphasis on an Ovarian Hormone," on May 9.

G. W. LITTLEHALES, of the U. S. Hydrographic Office, gave a lecture on "The Progress of Science in Oceanography" before the students of the Postgraduate School of the U. S. Naval Academy, Annapolis, on May 7.

DR. GEORGE L. CLARK, professor of applied chemical research and divisional director of the research laboratory of applied chemistry in the Massachusetts Institute of Technology, has been selected to deliver the second Edgar Marburg lecture at the annual meeting of the American Society of Testing Materials, at French Lick, Ind., which opens on June 20. Dr. Clark's subject will be "X-rays in Industry."

PROFESSOR WILLIAM WOOLSEY JOHNSON, formerly professor of mathematics in the U. S. Naval Academy, died on May 14, aged eighty-five years.

DR. WILLIAM P. WILSON, formerly professor of botany at the University of Pennsylvania and since 1894 director of the Philadelphia Commercial Museums, died on May 12, aged eighty-three years.

DR. ALFRED H. LLOYD, professor of philosophy and dean of the graduate school of the University of Michigan, died on May 10 at the age of sixty-three years.

DR. IRA WOOLSON, consulting engineer, formerly adjunct professor of civil engineering in Columbia University, died on May 8 at the age of seventy-one years.

PROFESSOR ERNEST STARLING, who held a Foulerton professorship of the Royal Society at University College, London, died on board a steamer as it was entering Kingston Harbor, Jamaica, on May 2. Professor Starling was sixty-one years of age.

DR. ABRAHAM LEVIN, the Russian physiologist, who has been associated with Professor A. V. Hill at University College, London, died on April 20.

PROFESSOR JENS FREDRIK SCHROETER, head of the University Observatory at Oslo and the author of various works on astronomy, died on April 28, aged seventy years.

DURING the absence of Dr. R. G. Harrison in Europe (June, 1927–September, 1928), manuscripts intended for publication in the *Journal of Experimental Zoology* should be sent to the Wistar Institute, 36th Street and Woodland Avenue, Philadelphia, Pa.

THE Rumford Fund of the American Academy of Arts and Sciences offers an opportunity to research workers in the domain of heat and light (including X-rays) to receive financial aid in obtaining apparatus, material or experimental equipment, or in publishing results. The committee in charge of the fund welcomes applications for such aid from duly qualified persons anywhere in North America or in any of the American islands. Applications for grants should be addressed to the Chairman Rumford Committee, American Academy of Arts and Sciences, 28 Newbury Street, Boston, Massachusetts, and should specify the nature of the research and the sort and amount of aid desired.

THE United States Civil Service Commission announces a vacancy in the position of senior aeronautical engineer at the Langley Memorial Aeronautical Laboratory, Langley Field, Va., and that in view of the importance of the position in the field of aeronautical research, and in order to secure the appointment of a thoroughly qualified man for the work, instead of the usual form of civil service examination, the qualifications of candidates will be passed upon by a special board of examiners, composed of Dr. G. W. Lewis, director of aeronautical research, National Advisory Committee for Aeronautics; Dr. F. C. Brown, acting director of the Museums of the Peaceful Arts; Mr. Starr Truscott, aeronautical engineer, National Advisory Committee, and Messrs. A. S. Ernest and A. W. Volkmer, examiners of the Civil Service Commission. The entrance salary for the position is $5,000 a year. Applications must be received before June 14.

DR. A. M. PETER, secretary of the Kentucky Academy of Science, writes that the academy held its fourteenth annual meeting on May 7 at the University of Kentucky. The division of philosophy and psychology was added to the organization and held a successful meeting. Officers elected were: *President,* Dr. W. D. Valleau; *vice-president,* Professor C. S. Crouse; *secretary,* Dr. A. M. Peter; *treasurer,* Professor W. S. Anderson, all of the University of Kentucky; representative in the council of the American Association for the Advancement of Science, Dr. Austin R. Middleton, University of Louisville. *President* of the division of biological sciences, Dr. G. D. Buckner; *secretary,* Professor E. N. Fergus. *President* of the division of physical sciences, Dr. W. R. Jillson; *secretary,* Professor C. S. Crouse. *President* of the divi-

sion of philosophy and psychology, Dr. M. A. Caldwell; *secretary*, same.

THE thirtieth annual meeting of the American Society for Testing Materials, which will be held at the French Lick Springs Hotel, French Lick, Ind., will open on Monday, June 20. The first day has been reserved for committee meetings and registration. The general opening session will be held on Tuesday afternoon at 2 o'clock. Immediately following this, two simultaneous technical sessions will be convened at 3 p. m. As in the past, simultaneous sessions on a number of occasions will be necessary but the general opening session and the closing session and two other sessions, one devoted to testing and the presidential address and the other to a discussion of corrosion and fatigue, will be single sessions. In addition one session devoted exclusively to the Edgar Marburg Lecture has been arranged for Wednesday afternoon. In all, thirteen sessions will be held.

DR. IRVING LANGMUIR, of the Research Laboratories, General Electric Company, Schenectady, gave the following series of lectures at the University of Texas during the week of April 11–15: "Electric Discharges in High Vacuum," "Ionization of Gases and Fundamental Effects of Positive Ions," "The Use of Collectors in the Study of Gaseous Discharges," "Velocities and Directions of Motion of Electrons and Ions," "Discharges at Higher Pressures—The Streamer Discharges," "Recent Advances in Astronomy," "Absorption and Chemical Reactions on Surfaces," "Interfaces between Liquids and in Solutions of Organic Substances."

PUBLIC lectures will be given in the museum building of the New York Botanical Garden at 4:00 o'clock on Sunday afternoons as follows: May 7, "Tulips," Mr. Kenneth R. Boynton; May 14, "The Present Status of Evolution," Professor Henry C. Cowles; May 21, "Irises for the Home Garden," Mrs. Wheeler H. Peckham; May 28, "New Varieties of Old Perennials," Professor Alfred C. Hottes; June 4, "Relation of Soils to Plant Growth," Dr. B. A. Keen; June 11, "Louis Pasteur," Dr. Israel Weinstein; June 18, "Botanizing in the Mountains of Colorado," Dr. F. J. Seaver; June 25, "The Plant Life of the Sea," Dr. Marshall A. Howe.

PLANS for the organization of the scientific men of Chicago were formulated at a meeting of thirty-two university scientists and business men in lines associated with the sciences at the Union League Club on May 16. The plan is to bring into affiliation for the purpose of following the progress of science the large group of men in business, the professions and the universities in the Chicago area. The 450 or more members of Sigma Xi, national honorary, scientific fraternity, living in the city and its environs, will constitute the nucleus. Speakers representing the University of Chicago, Northwestern University, the University of Illinois, Armour Institute, the Field Museum and the Western Electric Company endorsed the plan and pledged their support. Forrest R. Moulton, national president of Sigma Xi, and one of the speakers, was elected chairman of the temporary executive committee, and Mr. Donald H. Sweet, patent attorney, was elected corresponding secretary.

THE Daniel Guggenheim Fund for the Promotion of Aeronautics has authorized a grant of $5,000 to help finance the second University of Michigan expedition, which will investigate atmospheric and climatic conditions in Greenland and in the north Atlantic Ocean. This grant represents a fourth of the estimated cost of the expedition, and is contingent upon the raising of the additional $15,000.

AT a meeting of the New York and New Jersey branches of the Society for the Promotion of Engineering Education at Princeton University on May 14, it was announced that the Carnegie Corporation has presented $7,500 to the society for two summer schools, one at Cornell University and one at the University of Wisconsin, for three weeks of instruction to engineering teachers.

A FELLOWSHIP in the chemotherapy of cancer will be established at Cornell University Medical College under the terms of a gift of $5,000 a year for five years, made by L. N. Littauer, of Gloversville, according to an announcement of Dr. James Ewing, professor of pathology in the college.

THE receipt of two fellowships amounting to $750 each by the Princeton School of Engineering has been announced by Arthur M. Greene, Jr., dean of the school. The fellowships given by the Du Pont Company of Delaware are to be granted for a fifth-year course, one in chemistry and one in engineering.

ANNOUNCEMENT of the temporary closing of the University Museum, at Ann Arbor, has been made by Alexander G. Ruthven, director. The exhibits are now being packed and will be stored until the completion of the new building now under construction. Work on the new structure is progressing rapidly. The foundations of the west wing have been laid and the excavation for the north wing is nearly completed.

THE museum in Yosemite Park is now completed and has been formally turned over to the Park Service. It was made possible by a gift from the Laura Spelman Rockefeller Memorial and gifts from other

sources, including the Yosemite Natural History Association of Museums. The museum consists of four large exhibition rooms, a lecture hall and library and stack room, headquarters for the natural guide service, workrooms and laboratories, and a large supply of exhibition material. It is to be used by visiting scientists, students and casual visitors. Funds are also in hand for starting the construction of a similar museum at the Grand Canyon, and surveys are being made in other national parks.

UNIVERSITY AND EDUCATIONAL NOTES

THE General Education Board has promised a gift of $850,000 to the Yale School of Medicine for medical teaching and study, provided that a new endowment of $1,150,000 is procured for the school from other sources.

A GIFT from the Rockefeller Foundation, said to be between $1,500,000 and $2,000,000, has enabled the University of London to obtain the Bloomsbury site for which it has been negotiating with the British government for years. The Rockefeller gift, together with a government grant of $1,000,000, covers the purchase of about thirty acres of land near the British Museum and part of the cost of constructing several new buildings.

THE International Education Board has given to the University of Edinburgh the sum of $150,000 towards the establishment of a chair for research in animal diseases.

DR. WILLIAM F. VERDI, professor of clinical medicine in the Yale Medical School, has given $10,000 as an addition to the Yale endowment fund for the establishment of a scholarship fund in memory of his mother, Mrs. Rosa Verdi, of New Haven.

DR. ARTHUR B. COBLE, professor of mathematics at the University of Illinois, has been appointed professor of mathematics at the Johns Hopkins University.

DR. WILLIAM DILLER MATTHEW, for more than thirty years connected with the American Museum of Natural History and since 1922 head of its paleontological work, has been appointed professor of paleontology at the University of California.

DR. VICTOR C. MYERS has been appointed professor of biochemistry in the school of medicine, Western Reserve University. Dr. Myers left the Post-Graduate Hospital in New York in 1924 to take the chair of biochemistry at the University of Iowa and will assume his new duties in Cleveland in September of this year.

DR. WILLIAM PHILLIPS GRAVES, professor of gynecology in the Harvard Medical School, has been elected the first incumbent of the W. H. Baker chair of gynecology in the school.

AT Yale University, Dr. J. P. Peters, associate professor of medicine, and Dr. R. G. Hussey, associate professor of pathology, have been promoted to full professorships. Dr. H. W. Haggard has been promoted to an associate professorship of applied physiology. Promotions to assistant professorships include those of Dr. O. L. Lawrence, in physics; Dr. W. M. Agar, geology; Dr. N. I. Adams, physics, and Dr. H. M. Gehman, mathematics.

PROFESSOR ALAN D. CAMPBELL, of the University of Arkansas, has been appointed professor of mathematics at Syracuse University, where he will carry on courses in advanced mathematics.

DR. MELVILLE H. HATCH, assistant professor of entomology of the department of zoology of the University of Minnesota, has been appointed assistant professor of zoology at the University of Washington.

THE faculty of medicine of the University of Padua has called Professor Cesare Frugoni, director of the Institute of Medical Pathology at the University of Florence, to the chair of clinical medicine, to succeed Professor Lucatello.

DISCUSSION AND CORRESPONDENCE

LABILITY IN FERRIC OXIDE HYDROSOLS

RESULTS obtained in this laboratory point to the existence of a labile state in concentrated ferric oxide hydrosols. The particular sol studied was prepared by hydrolysis of $FeCl_3$ at the boiling point of water and dialysis of the resulting impure sol at 92° C. The final product contained 3.5788 grams of iron per liter and showed a completely negative test for chloride ions.

Partial coagulation of this sol was induced by shaking at room temperature, by very gentle stirring with a cold glass rod or by inoculation with a drop of mechanically coagulated ferric oxide sol containing a few particles of the freshly formed coagulum. Coagulation was not complete in any case but reached a fairly definite value and then ceased. The supernatant sol, obtained by centrifuging out the coagulated portion, contained approximately 3.2 grams of iron per liter, was clear to transmitted light and showed complete stability toward agitation and inoculation. Agitation at 92° C., the temperature at which the sol was dialyzed, did not induce any coagu-

lation. Dilution of the sol with pure distilled water gradually decreased the coagulation up to a definite concentration beyond which no amount of agitation or inoculation gave any precipitate. The effect of dilution, however, is not the same sort of straight line function as one finds in dealing with supersaturation in true solutions.

Immaculate cleanliness was observed throughout. All tests were carried out in sealed Pyrex tubes, thereby minimizing glass solubility effects and eliminating the influence of contact with cork or rubber stoppers. Since contact with Pyrex alone, without agitation, gave no coagulation even after several weeks, the possibility of adsorption or surface catalysis exerting any influence seems out of the question.

The results cited are merely preliminary. A thorough study of the observed phenomena is now under way in this laboratory.

C. H. SORUM

THE RESEARCH LABORATORY OF GENERAL CHEMISTRY, UNIVERSITY OF WISCONSIN

"FINGER PRINTS" OF MINERALS

RECENT developments in our knowledge of X-rays have made it possible to use them in the study of all sorts of solid matter. Truly solid matter consists exclusively of crystals each of which is composed of atoms having a perfectly definite and regular arrangement. These atoms form parallel planes in various positions through the crystal just as the hills of corn planted by machine on a level field form parallel straight lines in several positions across the field. The distance between any two adjacent planes determines the angle at which X-rays are reflected (in phase) by these planes. By exposing a finely powdered crystal to a beam of X-rays reflections can be obtained simultaneously from all the parallel planes in the crystal. These reflections make angles with the incident beam of X-rays which depend directly upon the distances between the planes of atoms. All crystals of the same kind produce reflections which are identical in intensity and positions, while two crystals which are not alike produce reflections which are unlike.[1] Accordingly, every kind of crystal can be made to produce its own characteristic X-ray pattern or autograph.

Scientists in this country and in Europe have obtained such autographs or "finger prints" and studied them in various ways. So far as known to the writer, no scientist nor institution has attempted to establish a reference collection of standard autographs, and the Department of Geology of the University of Wisconsin has undertaken this task.

It is evident that such autographs are most valuable as reference standards when they are obtained from substances whose nature and composition are fully known. Therefore, analyzed samples of all kinds of minerals are needed for the establishment of such standards. A very small portion of the material is sufficient—in some cases an autograph can be made from fifty milligrams of mineral.

In order to make it possible to identify X-ray patterns from unknown material it is important to make the collection of autographs from known material as complete as possible. At the present time about 550 autographs have been made, which include only 170 standards, the others being for purposes of identifying unknown minerals, for special problems relating to crystal structure, etc. The Department of Geology of the University of Wisconsin is anxious to obtain analyzed mineral samples to enlarge its collection of standard autographs as rapidly as possible. For this reason an X-ray pattern of such material will be supplied free of charge to any one supplying a sample together with an accurate chemical analysis.

A. N. WINCHELL

UNIVERSITY OF WISCONSIN

[1] A few exceptions to this rule have been discovered; most of these are easily understood.

CORRELATION OF MEXICAN BEAN BEETLE POPULATION WITH ORIGINAL FOREST TYPE

THE Mexican bean beetle (*Epilachna corrupta* Muls.) was first discovered in Ohio in 1923, having spread from northern Alabama in three years. Through the cooperation of the Ohio Experiment Station, the Ohio State University and the Bureau of Entomology, records of distribution were obtained which showed that it was present in about ten counties in the south central portion of the State of Ohio.

The distribution of the beetle in Ohio in 1924 presented an interesting problem. It was easily found, and in many cases was abundant in the southern third of the state and very scarce in the remainder. Mr. M. P. Jones, assistant to Dr. D. M. DeLong, who was engaged by the Bureau of Entomology during the summer on the bean beetle project, consulted with Dr. E. N. Transeau, of Ohio State University, regarding the explanation of this distribution. Dr. Transeau had just returned from a trip over the eastern part of the state and noted immediately that the map showing the area of greater population coincided quite closely with what was then known of the distribution of the original mixed mesophytic type of forest.

In 1925 serious injury to beans occurred in the southern portion of the state. In 1926 the writer carried on further studies in cooperation with the organizations and men mentioned above. It appears that there is a striking correlation between a map showing the economic damage done by the Mexican bean beetle and a map showing the original mixed mesophytic forest prepared by Drs. E. N. Transeau and H. C. Sampson and as yet unpublished. Economic damage to the bean crop in Ohio was confined to the habitat originally occupied by the mixed mesophytic forest in the southern third of the state, with the possible exception of two restricted infestations. This area covers, roughly, the territory south of a line running from Preble County on the west to Fairfield County and thence to Licking County and northeast to Columbiana County.

The distribution of the insect in Ohio[1] corresponds with the trend indicated earlier when studies were being carried on in the southeastern states.[2] It was noted in 1921 that the preferred habitat appeared to be the slopes and valleys in the mountainous or hilly regions.

Studies of evaporation and climate are being made with the aim of analyzing the observations made and to ascertain if such studies may be of value in affording an index for use in forecasting the limits of economic damage of an introduced insect pest in its new habitat. Dr. Transeau informs me that he will soon publish a paper in *Ecology* regarding this important principle.

NEALE F. HOWARD

BUREAU OF ENTOMOLOGY,
U. S. DEPARTMENT OF AGRICULTURE

CONFUSION IN SCIENTIFIC TERMINOLOGY

THE writer agrees with Professor Uhler's protest regarding the present confusion in the terminology of science. The situation apparently requires the creation of an international commission, involving the English-speaking peoples, which might attempt to standardize the symbols and terms used commonly by physicists, chemists, engineers and mathematicians. A joint committee of the American Association and the British Association for the Advancement of Science should serve the purpose as well as any other representatives.

The International Electrotechnical Commission obviously could not function because the problem relates to English usage and is not limited to electrical subjects. A comprehensive effort toward promoting uniformity in electrical terms is embodied in the work of the Standards Committee of the American Institute of Electrical Engineers. These standards are not recognized, however, by other scientific or engineering interests and are not given sufficient attention by the electrical engineers themselves.

Over ten years ago the electrical engineers decided with good reason that "electrostatic capacity" should henceforth be called "capacitance." Physicists in general have not adopted the new term and in consequence the student passing from his physics courses to electrical engineering subjects is obliged to change his vocabulary. It is the practice of most electrical engineers to use "pound-foot" as a unit of torque, while mechanical engineers commonly use the "foot-pound." The confusion of the latter unit with the same unit of energy is a source of distress to students in elementary mechanics.

The writer has always surmised that the word "voltage," so commonly used to-day, was originally coined by a plumber while engaged in colloquial conversation with his helper. To be consistent one should substitute "amperage" for "current," "ohmage" for "resistance," "gaussage" for "flux density," "kilowatt-hourage" for "energy," etc. Indeed, if one caught the habit, and "garb" were used for "clothing" it should be plumberized into "garbage." If it is argued that "voltage" is justified by the suggestion that the unit is to be in volts in the same manner that "acreage" of land suggests that the unit be in acres, it is without foundation, since the volt is the only practical unit.

The oldest and most rational claimant for the title is "potential." "Difference of potential" or "potential difference" adds nothing to the meaning, since the term applies only to the condition between two specified points, just as we use the word "distance" and not "difference of distance." "Potential difference," moreover, usually involves the use of the clumsy symbol "P.D." Whatever term is adopted it is hoped that some effort may be made to rid from electrical terminology the chain of analogous terms, such as voltage, potential difference, pressure and tension, which only serve to confuse the student and add nothing to the clarity of the meaning.

The situation is further confused when no attempt is made to distinguish between electromotive force and potential. In an early issue of one of the first electrical engineering journals published in the United States (*The Electrician and Electrical Engineer*, of 1884) a writer says, "In fact the terms emf and potential (thus) have been indiscriminately employed in the same sense by writers on electrical subjects to the great confusion of the student." It is a curious fact that this confusion has continued for forty-three years. The amateur radio fan is oblivious of all this. To him everything is "voltage."

[1] DeLong, D. M. *Jr. Ec. Ent.*, Vol. 19, 1926, p. 247.
[2] Howard, Neale F. *Loc. cit.*, Vol. 15, 1922, p. 266.

Another matter that deserves attention is the pronunciation of the terms and symbols. Who has not heard the word "centimeter" pronounced with a French beginning and an English ending? The writer as a student thought from the class-room pronunciation that Joule was a Frenchman until his biography chanced to come into view. The pronunciation of Greek symbols runs all the way from the Doric to the Attic. The writer recently ran across a text in which it was explained that "micro" was Greek for "millionth."

It is most unfortunate in mathematical discussions that the letters of the English alphabet have no distinctive names. It is troublesome enough over the telephone, but when the letters C and Z come through the filter of a professorial full beard the probability of distinction is fifty-fifty. The English have of course avoided this confusion by calling the latter letter "zed."

The importance of taking immediate action in the matter is well illustrated by Professor Uhler's reference to the present usage of the word "battery." It is probable that "battery" has been used incorrectly in place of "cell" for at least thirty years. It is doubtful indeed that a present attempt to revert to the proper usage would have any measure of success.

R. G. HUDSON

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

SCIENTIFIC BOOKS

The Elements of General Zoology. A Guide to the Study of Animal Biology Correlating Function and Structure with Notes on Practical Exercises. By WILLIAM J. DAKIN. Oxford University Press, London (American Branch, New York) VII + 1—496 pp., 252 figs. 1927.

ZOOLOGY is so rapidly becoming an experimental science that the need for an elementary text stressing the physiological rather than the morphological aspect has been keenly felt by many teachers. Professor William J. Dakin has attempted to meet this demand by writing a text-book of physiology illustrated by numerous examples from all fields of zoology. Among the topics considered in this very attractive volume are: the composition of the animal body, nutrition, respiration and the respiratory organs, the blood and its circulation, temperature and animal life, movement of animals, nervous system and sense organs, excretion, growth and reproduction, etc. The book affords an excellent outline for those teachers desiring to change the usual course in general zoology into a more physiological one.

It must be admitted, however, that the title is somewhat misleading, for only a few of the elements of general zoology are included in the work, while others are treated very inadequately. Such is particularly true of the brief chapter on heredity and evolution. The shortcomings of the physiological approach to a general course in zoology are all too obvious in the chapter on the skeleton, where various parts are considered as so many distinct types of machines and no suggestion is given as to how one type has evolved from another. To-day, when function is being emphasized, frequently to the exclusion of form, beginning students should be made to realize that many structures, such as the thyroid, for example, may assume totally new functions in vertebrate evolution without losing their morphological identity. It is evolution which makes zoology a unified science and the student of zoology at the outset of his career should be given the opportunity of glimpsing the whole edifice of animal life before being called upon to analyze the functions of its various parts.

Professor Dakin's book is splendidly illustrated and the many original diagrams will be welcomed by all teachers of zoology. Some teachers, however, will consider the scattering of laboratory directions throughout the body of the text a decided disadvantage from the pedagogical standpoint. Further, one can not help but wonder how long a book without head bands will last in the hands of the average college student.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NEW DEVICE FOR FILING MICROSCOPE SLIDES[1]

THE usual difficulties in filing microscopic preparations mounted on glass slides are: (a) They are inaccessible or lost among hundreds of others filed in small boxes of one sort or another; (b) the more elaborate small cabinets designed for this purpose are relatively expensive and inelastic; (c) slides filed one against the other in drawers stick together and are easily broken; (d) bacterial smears, which are usually without coverslips and sticky with immersion oil, can not be filed one against the other; (e) it is time-consuming to hunt up slides filed in one place and notes filed in another. The device to be described is believed to overcome these difficulties.

A piece of sheet metal, preferably aluminum, three

[1] From the Department of Pathology and Bacteriology of Johns Hopkins University, Baltimore, Maryland.

by five inches in size, is stamped and bent as shown in Fig. 1. There are runways to hold four slides. The lower edge is turned to support the lower ends of the slides. The upper edge is cut with semicircular notches to facilitate grasping the slides and is slotted between the slides and bent forward slightly

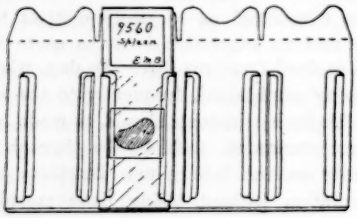

FIG. 1

where indicated by the dotted line so as to exert pressure against the upper ends of the slides, holding them in place so that they do not fall out if the holder is held upside down. As the upper ends of the slides are forced forward against the upper ends of the runways the lower ends are forced backward away from the runways so that the coverslips are not in contact with the runways. The slide labels are conspicuously in view at the upper ends of the slides. With the forefinger against the back of the holder and the thumb against the label a little pressure serves to disengage the slide and allow it to be withdrawn without scraping the coverslip against the runways. The holders containing slides may be filed along with cards bearing notes in any ordinary card-filing box or drawer of standard size for 3 x 5 inch cards as shown in Fig. 2. When so filed the slide labels are easily read without removing the slides or holders from the filing drawer. The surfaces of the slides are protected from contact with each other or with cards that may be filed with them, even though the slides may be without coverslips and sticky with immersion oil. About five hundred slides may be filed in one foot of drawer space. The device is equally useful for small or large collections of slides.

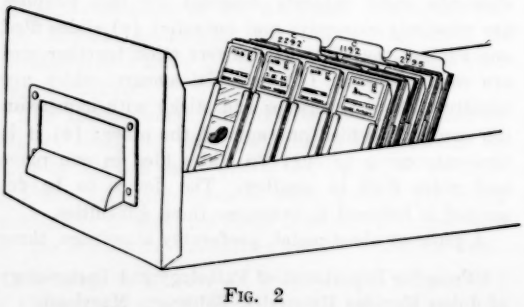

FIG. 2

No special equipment is needed other than the holders and these may be procured in any quantity desired and as needed. The filing cost per slide will probably be somewhat greater than when the cheaper slide boxes are used but less than that of special cabinets and filing drawers.

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A METHOD OF HANDLING SMALL OBJECTS PREVIOUS TO SECTIONING

TINY marine eggs, such as those of cumingia, are fixed in shell vials measuring one and a half centimeters in diameter and three centimeters in height. The eggs settle rapidly to the bottom in most fixing fluids, and, after the proper interval of time the fixing fluid may be removed by tilting the vial and using a curved tipped pipette. The vial is next flooded with water or alcoholic solution of the desired strength. After each successive treatment the eggs sink to the bottom, and most of the fluid which covers them is easily withdrawn by means of the pipette. Upon reaching 75 per cent. or 85 per cent. alcohol, the vial is stoppered, a gummed label bearing the proper index is affixed and the stoppered end is dipped in melted hard paraffin deep enough to cover the label. The vial is thus sealed and the label protected by a film of hard paraffin.

When the worker is ready to dehydrate, clear and infiltrate his material, the stopper is removed from the vial, the preserving alcohol drawn off with a pipette, and the vial filled with 95 per cent. alcohol. The dehydrating and clearing fluids are added or withdrawn in the same manner after proper intervals of time, and the material flooded with melted paraffin. At this point it is well to slip a small elastic band tightly over the label, since the heat of the paraffin oven sometimes loosens a label. The paraffin may be changed as desired by using a warm pipette.

Thus far, the eggs have never left the vial in which they were fixed. For casting the material into paraffin blocks, small rectangular porcelain dishes in which artist's water colors are purchased will prove satisfactory. These little dishes with flaring sides measure approximately two centimeters in length, one and one half centimeters in length, and one half centimeter in depth. The bottoms and sides of these casting molds are lightly smeared with glycerine or vaseline. Paraffin is next withdrawn from the vial until only enough remains to fill the casting dish, the vial is passed rapidly once or twice over an alcohol flame, and its contents poured into the porcelain receptacle. At the proper moment, the paraffin is hardened by submerging under 70 per cent. alcohol or water. After hardening, the point of a scalpel

inserted between the side of the dish and the paraffin, loosens the block and it readily drops out if the dish be inverted. The block may be trimmed immediately, or, slipped back into the original vial and left indefinitely.

By regulating the temperature of the paraffin at the time of casting, the worker may have his material either distributed evenly through the block or the eggs may be allowed to settle enmasse to the bottom of the dish.

Comparatively few eggs are lost when this method is followed. It is especially advantageous when lots of fifty or a hundred stages have to be carried through, since there is a minimum probability of different lots mixed, and the material is on file from the moment of fixation.

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SPECIAL ARTICLES

THE CHLORIDES OF RUTHENIUM

A YEAR and a half ago[1] Mr. F. N. Mercer and I published a paper in which we described a method of separating ruthenium quantitatively by solution in sodium hypochlorite and distillation in a current of chlorine. At that time we had not found any simple way of analyzing the solution of pure ruthenium which distils over, reduction methods failing owing to the presence of free chlorine in the solution.

Since that time I have found that if the distillate is absorbed in concentrated hydrochloric acid, the solution can be titrated with stannous chloride, thus affording a simple method of determining small quantities of ruthenium, and also, by using aliquot portions, of evaluating solutions of ruthenium in chloro-ruthenate form.

The reaction depends upon the fact that ruthenium tetroxide, RuO_4, is reduced in hydrochloric acid solutions to quadrivalent form, and that dilute stannous chloride reduces quadrivalent ruthenium to trivalent ruthenium, and no farther, even under quite variable conditions. The change in color of the ruthenium solution from deep red to rose is quite recognizable, but for accuracy a slight excess of stannous chloride is added, and the solution titrated back with iodine solution, starch paste being used as an indicator.

There has been much discussion regarding the different valence states of ruthenium and especially as to what is formed when the volatile tetroxide is reduced by hydrochloric acid. When the tetroxide is boiled with hydrochloric acid and potassium chloride added, there crystallizes out a salt which has, since the days of Claus, its discoverer, passed as K_2RuCl_5, derived from the pentachloro-ruthenous acid, H_2RuCl_5, this in turn being a derivative of ruthenium trichloride, $RuCl_3$. From this it has been naturally assumed that the valence of ruthenium in this compound is three. On the other hand, Krauss, as well as Remy, have conclusively proved that the ruthenium in RuO_4, on reduction by hydrochloric acid, is reduced only four valences. It has therefore been assumed that $RuCl_4$ (H_2RuCl_6) is first formed, and that the $RuCl_3$ (H_2RuCl_5) is the result of further reduction.

The result of titration with stannous chloride, however, shows that the ruthenium in both H_2RuCl_6 and H_2RuCl_5 (as supposed) is quadrivalent, each being reduced a single valence to the real H_2RuCl_5. With KCl (or other alkali chlorides) $K_2RuCl_5(H_2O)$, first recognized by me in 1901[2] and then called an "aquo"-salt, is formed. This must be recognized as the true pentachloro-ruthenite, crystallizing with one molecule of water, as would be expected from the Werner theory.

This was suggested by Charonnat in 1925,[3] on the basis of the reduction of the (supposed) K_2RuCl_5 by potassium iodide, and the formation of the aquo-salt by the action of hydrochloric acid on the oxalate, $K_3Ru(Ox)_3$, in which the ruthenium is undoubtedly trivalent. No analyses were published, however, to substantiate this observation, which was unquestionably correct, and it seems to have been overlooked.

Since the K_2RuCl_6 can be formed by the recrystallization of the (supposed) K_2RuCl_5 from very concentrated hydrochloric acid, and the K_2RuCl_5 is formed when the K_2RuCl_6 is recrystallized from dilute, or even moderately strong hydrochloric acid, and since the valence of the ruthenium is the same in both salts, it is probable, as Charonnat assumes, that the pentachloride salt is actually a hydroxy-salt, K_2RuCl_5OH, formed from the hexa-salt, K_2RuCl_6, by hydrolysis.

It is interesting to note that within wide limits the hexachloro-ruthenate is hydrolyzed to the extent of one chlorine atom only and that this product in water, in absence of hydrochloric acid, is further hydrolyzed to $RuCl(OH)_3$, while the true pentachloro-ruthenite, ("aquo" salt), is hydrolyzed only to $RuCl_2(OH)$.[4]

Fuller details of this research will appear later in the *Journal* of the American Chemical Society.

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[1] J. Amer. Chem. Soc., 47 (1925), 2926.

[2] *Ibid.*, 23 (1901), 781.

[3] Compt. rend., 181 (1925), 866.

[4] Lind and Bliss, *J.* Amer. Chem. Soc., 31 (1909), 868.

STUDIES IN MICROBIAL THERMOGENESIS

I. APPARATUS

ONE result of the ever-increasing demand for greater production has been a more and more incomplete "seasoning" of farm products. In many localities hays and grains are stored in a wholly uncured condition. The principal danger from this procedure lies in the "heating" which almost inevitably follows. This heating is usually accompanied by fermentation and rotting of the material, which results in a depletion of its nutritive and market values.

Most of the types of apparatus devised for the study of microbial thermogenesis have been arranged for the determination of the total number of calories of heat liberated. In an investigation concerned primarily with the maximum temperature attainable under known conditions, an apparatus furnishing the most complete insulation against radiation and the most favorable rate of gaseous exchange is desired.

In the early stages of the "spontaneous" heat production in stored organic materials[1] a considerable amount of air must be entrapped within the mass. For this reason experiments were confined to studies of the effect of aeration with oxygen. As the gases introduced will absorb heat and those escaping after the heating will remove some of the heat, it is preferable to operate with as small a gas volume as possible. For these reasons pure oxygen is used. Insulation of the mass is accomplished by packing in a commercial Dewar flask. Further insulation against radiation may be obtained by packing the flask in sawdust or powdered cork. This added precaution was found to be unnecessary for ordinary materials, however. The apparatus devised by the writer, and which has proved to be satisfactory, is shown in Fig. 1.

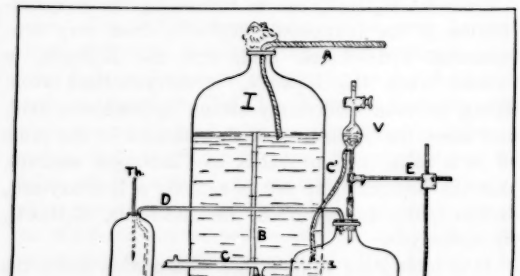

Figure 1 Aeration Apparatus for the Study of Spontaneous Heat Production.

FIG. 1. Aeration apparatus for the study of "Spontaneous" Heat Production.

In order to prevent corrosion, glass or brass is used in the apparatus as far as possible. The material to be studied is packed in a quart Dewar flask (III), which contains an "oxygen tube" (dotted) made from small glass tubing bent to conform to the inside wall of the flask. The lower end of the tube is turned up, with the opening in the center and near the bottom of the flask. After the material is packed in the container, a thermometer (Th) is inserted. At a favorable point in the experiment the oxygen tube is connected with the oxygen bottle (II) by glass tubing (D), connections being made through closely fitting rubber tubing. The oxygen is forced out of the oxygen bottle and into the Dewar flask by water dripping from the bevelled tip of a glass tube extending through the rubber stopper. The rate of water flow into this bottle is governed by the water head established by the valve (V). The large bottle (I) furnishes a constant level of water, (A) being the inlet and (B) the overflow. This constant head is transmitted to the valve through the manifold (C) and the rubber tubing (C'). The capillary valve (V) is held in a clamp which can be raised or lowered at will. Thus the vertical distance between the top of the water in (I) and the lower end of the capillary of the valve determine the rate of water flow from the bevelled tip leading into bottle (II).

By determining the number of drops from each tip per liter of water delivered, the volume of each drop can be calculated. At any position of the valve the rate of flow per hour can then readily be computed from the number of drops falling per minute. It is convenient to have a computing table for ready reference.

The bulb in the capillary valve surmounted by the glass stop-cock was found necessary to hold bubbles of air liberated from the cold water as its temperature rose to that of the room during its slow passage through the manifold (C) and rubber tubing (C'). This was particularly useful in winter. The oxygen bottle (II) is easily filled with oxygen by first filling with water. Absorption of the oxygen into water which collects in the bottle and the liberation of air from the water into the oxygen above can be prevented by the addition of a few cubic centimeters of paraffin oil. The effect of different gases upon the

[1] "Organic materials" is used in this paper to denote those plant and animal substances which, when piled, produce a porous mass and which would naturally fall within the scope of this investigation.

heat production can readily be determined by a simple substitution of bottles containing the desired gas.

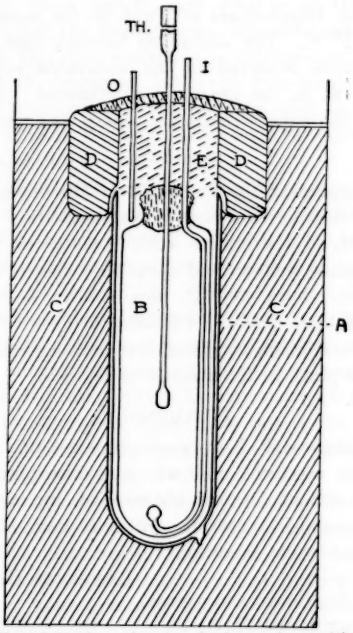

FIG. 2. Chamber for the insulation of sterilized and reinoculated materials.

Studies on sterilized and reinoculated materials can be more readily conducted if the insulating chamber of Figure 1 is substituted by one such as illustrated in Fig. 2. A wide-mouthed Dewar flask "A" (Fig. 2, a commercial vacuum food jar) is insulated in a wooden box with powdered cork "C." Two inches of magnesium-asbestos pipe covering "D" surmounts the flask in order to increase the depth of the chamber and also to place the vacuum jar well below the surface of the cork. The cylindrical hard glass receptacle "B" containing the test material is inserted into the flask and shredded asbestos fiber "E" packed into the opening above. The cylinder "B" is stoppered with cotton. The oxygen inlet tube "I" and thermometer "Th" correspond to those of Figure 1. An outlet "O" is also provided for waste gases.

PRELIMINARY EXPERIMENTS[2]

1. *Cornmeal (yellow commercial).* Two Dewar flasks were filled with cornmeal, the moisture content of which had been increased to about 25 per cent. No oxygen was introduced other than that incorporated during packing. The results, given in Table 1, show increases in temperature from 27.6° and 27.3° C. to maxima of 31.3° C. and 32.7° C., respectively, followed by decreases to room temperature again within two days. When examined, the meal appeared only slightly abnormal, being loosely caked with a small amount of mold.

Only one of many experiments performed to show the advantage of aeration with oxygen will be given.

TABLE 1

MOISTENED CORNMEAL PACKED IN DEWAR FLASKS AND UNAERATED

Days 1924	Time	Room Temp. °C.	Dewar No. 1 Temp. °C.	Dewar No. 1 Oxy'n cc/hr	Dewar No. 2 Temp. °C.	Dewar No. 2 Oxy'n cc/hr
0	11:00 a.m.		Packed	0	Packed	0
	2:00 p.m.	26.2	27.6		27.3	
1	9:00 a.m.	25.5	30.8		31.5	
	4:30 p.m.	26.0	31.3		32.7	
2	9:00 a.m.	23.8	30.4		32.7	
	4:30 p.m.	26.6	29.4		32.1	
3	9:00 a.m.	27.0	28.8		31.7	
	4:30 p.m.	29.5	29.1		32.1	
4	9:00 a.m.	28.0	30.1		32.6	
6			Room temp.		Room temp.	
7			Room temp.		Room temp.	

TABLE 2

MOISTENED CORNMEAL PACKED IN DEWAR FLASKS AND AERATED WITH OXYGEN

Days 1924	Time	Room Temp. °C.	Dewar No. 9 Temp. °C.	Dewar No. 9 Oxy'n cc/hr	Dewar No. 10 Temp. °C.	Dewar No. 10 Oxy'n cc/hr
0	4:00 p.m.		Packed		Packed	
1	9:00 a.m.	26.5	28.1		26.7	
	3:00 p.m.	27.5	28.3		27.3	
2	9:00 a.m.	26.0	30.6	*144*[3]	30.6	*160*
	3:00 p.m.	27.0	33.4	108	34.5	115
	3:05			*216*		*230*
3	9:00 a.m.	25.5	42.6	29	48.3	190
	9:05			*144*		*152*
	4:30 p.m.	25.0	44.7	158	47.4	150
4	11:00 a.m.	23.0	37.9	172	42.2	216
	8:30 p.m.	25.0	45.4		53.4	
5	10:00 a.m.	25.0	50.9		52.2	
6	9:00 a.m.	24.0	48.6		52.1	
	9:30 p.m.	25.5	54.4	200	60.4	208
7	9:00 a.m.	26.5	54.3		60.8	
	3:30 p.m.	25.0	54.5		62.0	

[2] More extensive studies are in progress and will be reported later.

[3] Figures in italics indicate the number of cubic centimeters of oxygen being delivered per hour immediately following an initial setting or a readjustment of the capillary valve.

Two flasks were again packed with cornmeal of 25 per cent. moisture content and, during the heating, oxygen was supplied from the oxygen bottle. Table 2 contains data condensed from many readings taken during the seven days of the experiment. Previous experiments had indicated that beginning the oxygen aeration immediately after packing the flasks frequently resulted in no appreciable rise in the temperature. If, however, the oxygen was started after the temperature had reached some point several degrees above that of the room, in this case a temperature of approximately 30° C., continued increases always occurred. Presumably the return to room temperature of the flasks reported in Table 1 was due to the exhaustion of the oxygen in the air entrapped during packing. The rates of oxygen supply (*i.e.*, the water flow) were variable in the experiment given. This was largely due to the fact that the valves had not been properly adjusted.

The maximum temperatures contained in Table 2 are considerably above those shown in Table 1. Had the experiment been continued longer with Dewar No. 9, a maximum temperature equal to that of Dewar No. 10 might have been attained. When examined the cornmeal in the aerated flasks was moist around the top, firmly caked and browned throughout and emitted a scorched odor.

2. *Cracked Corn* (*yellow commercial field*). Cracked field corn is to some extent similar to cornmeal, but it is even more subject to "spontaneous" heat production. Two flasks were packed with cracked corn of approximately 33.0 per cent. moisture, one receiving oxygen and the other remaining unaerated. The results are given in Table 3. The maximum temperature attained in the aerated flask was 62.5° C. The difference between that and the temperature observed in the unaerated mass is as striking as in the previous experiments. When examined the aerated corn was damp and very moldy.

TABLE 3

MOISTENED CRACKED FIELD CORN AERATED WITH OXYGEN AND UNAERATED CONTROL

Days 1924	Time	Room Temp. °C.	Dewar No. 3 Control Temp. °C. Packed	Dewar No. 3 Control Oxy'n cc/hr	Dewar No. 4 Temp. °C. Packed	Dewar No. 4 Oxy'n cc/hr
0	2:00 p.m.					
	6:00	26.9	23.3		25.8	
1	8:30 a.m.		22.0		27.0	
2	1:30 p.m.	24.2	23.1		34.6	
	2:00					*170*[4]
3	8:00 a.m.	23.8	21.3		45.2	160
	9:00 p.m.	28.0	25.5		50.4	162
4	8:00 a.m.	27.0	27.8		54.3	145
	8:00 p.m.	27.2	28.0		55.2	*175*
	5:00	27.2	27.5		56.0	
5	8:00 a.m.	22.5			60.0	
	8:00 p.m.	31.0			61.8	156
	9:30	32.5			62.5	
6	8:00 a.m.	20.5			51.5	120

[4] See footnote, Table 2.

SUMMARY

An apparatus for the study of the "spontaneous" heat production in stored organic materials[5] has been described. Experiments with commercial cornmeal and cracked yellow field corn have shown that temperatures above 60° C. can readily be produced under suitable conditions of moisture content, oxygen supply and insulation, and that marked heating does not take place in the absence of oxygen.

CONCLUSIONS

"Spontaneous" heat production is the result of oxidative reactions and will not take place to any marked extent in the absence of air or oxygen. Stored organic materials will not heat if retained under anaerobic conditions.

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[5] See footnote one.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE REGULAR SPRING MEETING OF THE EXECUTIVE COMMITTEE

ON April 24 the regular spring meeting of the executive committee of the council of the American Association for the Advancement of Science was held at the Cosmos Club in Washington. There were three sessions, in forenoon, afternoon and evening, and the members of the committee dined together as usual. The following members were present: Cattell, Fairchild, Humphreys, Kellogg, Livingston, A. A. Noyes, W. A. Noyes, Ward, and Wilson. Those absent were Moulton and Pupin. The following paragraphs give an account of the business transacted.

1. The reading of the minutes of the last meeting was omitted, since, as usual, these had been approved by mail.

2. The permanent secretary reported that all mem-

bers had been asked to send in names of persons who might be interested to become members of the association and that about eight hundred names had been thus received. Special invitations had been sent to all these persons and seventy of them had already joined the association. The excellent results secured in this way warrant the continuation of this new plan for securing names of prospective members. All members are requested to send in, at any time, the names of persons who may be expected to join the association.

3. The permanent secretary reported a net gain in membership, from September 30, 1926, to April 15, 1927, of 413, which is much larger than the net gain recorded for the corresponding period ending April 15, 1926, which is only 176. On April 15, 1927, there were 13,117 members in good standing and the total enrollment was 14,779. (It will be remembered that names of annual members are allowed to remain on the roll for two years after the expiration of the last year for which annual dues have been paid, names of all who are in arrears for two years being dropped from the roll on October 1 of each year.)

4. The permanent secretary reported on the space given to accounts of the recent Philadelphia meeting by the eight newspapers that were most active in this respect. A special study of this feature of the meeting had been made by Mr. W. E. Drake, who found that the eight newspapers gave to accounts of the meeting 1,391 column inches of space, not counting pictures. It was voted that the data of this study be published in SCIENCE and they will appear in a subsequent issue.

5. It was voted that societies meeting with the association be requested to exclude from their programs, as far as possible, papers that might be regarded as too sensational. This is to be considered as an expression of the association's attitude and of its ideals for the programs rather than as any adverse criticism of past programs.

6. It was voted that the permanent secretary offer the services of the Washington office to the approaching First International Congress of Soil Science, with special reference to the organization of the registration offices of the Congress, and that Mr. Woodley, of the Washington office, be requested to take this matter up with Dr. A. G. McCall, executive secretary of the Congress.

7. It was voted that the association's facilities for handling the registration, etc., of large meetings be placed at the disposal of other such science congresses as they may be planned.

8. As a special committee to consider the problem of non-technical science lectures and demonstrations, especially for high-school students, before and after the annual meeting, Dr. W. J. Humphreys reported that inquiry and a general study of the problem had led to the recommendation that one, two or three such lectures be planned for Nashville in the weeks preceding the second Nashville meeting, provided that this plan meets with the approval of the local committee for that meeting. It is understood that several non-technical lectures, complimentary to the people of Nashville, are to be arranged for the period of the meeting. It was pointed out that the attention of high-school students in the cities of the annual meetings might well be called to the nature and importance of scientific research as a career, with emphasis on the opportunities of science as well as of a knowledge of science.

9. The permanent secretary was empowered to expend five hundred dollars, or such part thereof as may be requisite, on arrangements for non-technical lectures before and during the period of the second Nashville meeting.

10. The sum of fifty-five dollars was appropriated from the permanent secretary's funds, to aid the American Institute of Sacred Literature in the publication and distribution of the institute's non-technical series of booklets on the Bible and its meaning. The institute is now distributing material bearing specially on the rational and critical consideration of the several Hebrew accounts of the Creation, contained in the Old Testament. The literature distributed by the institute is an important aid toward stemming the present tide of religious opposition to the advancement of science and science education in the United States.

10a. The sum of two hundred dollars was appropriated from the available funds in the treasury of the association, to aid the work of the Concilium Bibliographicum, of Zurich. The hope was expressed that ways may soon be found by which the Concilium Bibliographicum may cooperate fully with the international project of Biological Abstracts.

11. Ninety-seven members of the association were elected to fellowship, on nominations presented in the regular way. These are distributed among the several sections as follows: Section A (Mathematics), 2; Section B (Physics), 5; Section C (Chemistry), 11; Section D (Astronomy), 1; Section E (Geology and Geography), 2; Section F (Zoological Sciences), 12; Section G (Botanical Sciences), 30; Section H (Anthropology), 1; Section I (Psychology), 2; Section K (Social and Economic Sciences), 2; Section M (Engineering), 13; Section N (Medical Sciences), 11; Section O (Agriculture), 5. The work of securing the nomination of all members who should be fellows is being carried on with increasing efficiency by the section secretaries and the section committees.

12. On recommendation of the Joint Committee on Research in Colleges, it was voted that the American Association of University Professors and the American Association of Colleges be each asked to name a representative to be a member of the joint committee. The joint committee now consists of the following five members, representing different organizations.

Dr. Maynard M. Metcalf, *chairman*; representing the American Association for the Advancement of Science.

Dr. Vernon Kellogg, representing the National Research Council.

Dr. C. R. Mann, representing the American Council on Education.

Dr. Charles E. Merriam, representing the Social Science Research Council.

Dr. Edward C. Armstrong, representing the American Council of Learned Societies.

13. On application by its secretary, Dr. Arthur H. Graves, the Torrey Botanical Club was elected to official affiliation with the association. The club has 300 members, of whom 149 are members of the American Association. Of these association members, 104 are fellows. The newly affiliated society is to have two representatives in the association council, these being ex-officio members of the section committee for Section G (Botanical Sciences).

14. A special committee of the council of the association was appointed, on academy relations in general and on the advancement of the common interests of the academies of science and the American Association. This committee consists of Henry B. Ward, *chairman*, J. McKeen Cattell (chairman of the executive committee of the council), Burton E. Livingston (permanent secretary), and the council representatives of the affiliated academies of science. It was suggested that a complimentary dinner be arranged for the second Nashville meeting, to bring together the members of this committee.

15. The special committee on the arrangement with the *Science News-Letter*, of which committee Dr. J. McKeen Cattell is chairman, reported that this arrangement is operating satisfactorily. (The *Science News-Letter* is offered to members of the American Association at the special reduced price of three dollars a year and a similar offer is made with respect to *The Scientific Monthly*.) It was voted that the present arrangement be continued indefinitely, with the agreement that it may be terminated October 1 of any year, provided that either party (the American Association or Science Service) shall have given notice on or before the preceding July 1, of its wish to terminate the arrangement.

16. It was proposed that the books and pamphlets received by the association be turned over to the Smithsonian Institution, so far as they are not needed in the Washington office and so far as this arrangement will not discommode the library of the University of Cincinnati, which was for many years the repository of the library of the association. This matter was left in the hands of the permanent secretary.

17. It was voted that the American Association is desirous of cooperating with the Smithsonian Institution in every feasible way.

18. A letter from the donor of the funds for the American Association Prize (which is awarded annually to the author of an outstanding contribution to science presented at the annual meeting of the association and associated organizations) was read, in which he transmitted to the association the sum of three thousand dollars, to be added to the prize fund. (The name of the donor is withheld according to his wishes.) With this addition, the prize fund now amounts to five thousand dollars, providing for the annual prizes, of one thousand dollars each, to be awarded at the December meetings of 1927 (Nashville), 1928 (New York), 1929 (Des Moines), 1930 (Cleveland), 1931 (New Orleans). The gift of $3,000 was accepted by the executive committee, with cordial and appreciative thanks, and the permanent secretary was instructed to express to the donor the appreciation and gratitude of the association for the generous provisions made by him for the continuation of the annual prize award, which has become one of the outstanding features of the annual meetings of the association.

19. The permanent secretary was instructed to send out to all members next October 1 blanks for nominations for president of the association, at the same time furnishing each member with a list of the presidents for the last ten years, showing the field of science represented by each president. Members are to be asked to make nominations and the results are to be presented to the council at the second Nashville meeting.

20. The form of badge to be used at the second Nashville meeting was discussed and the permanent secretary was empowered to make arrangements for suitable badges.

21. On recommendation of the American Phytopathological Society, the Southern Association of Agricultural Workers was invited to meet with the American Association at Nashville and to have part in the programs of the second Nashville meeting.

BURTON E. LIVINGSTON,
Permanent Secretary.